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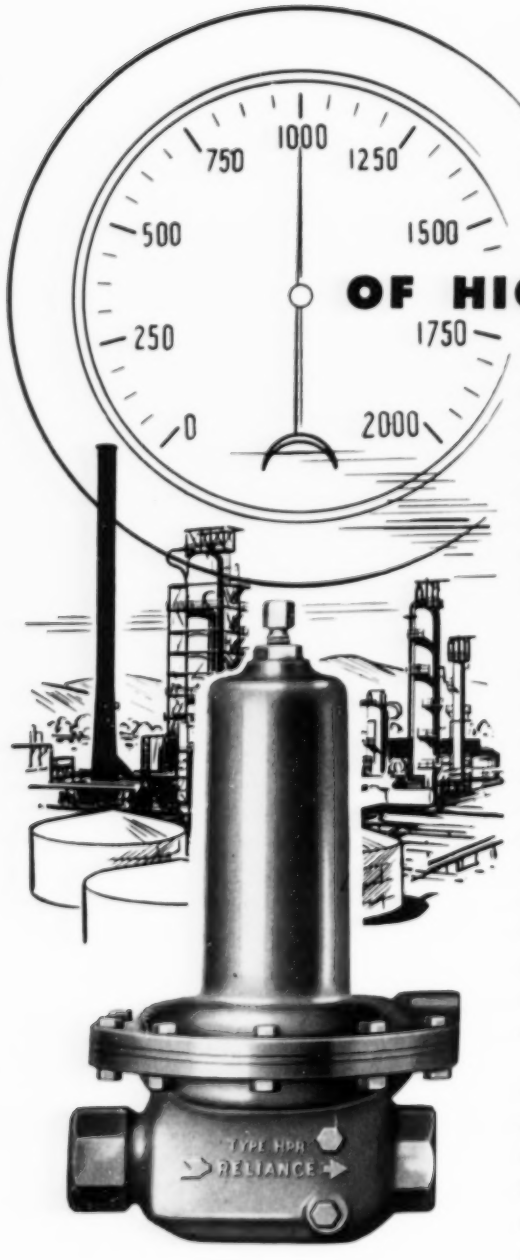

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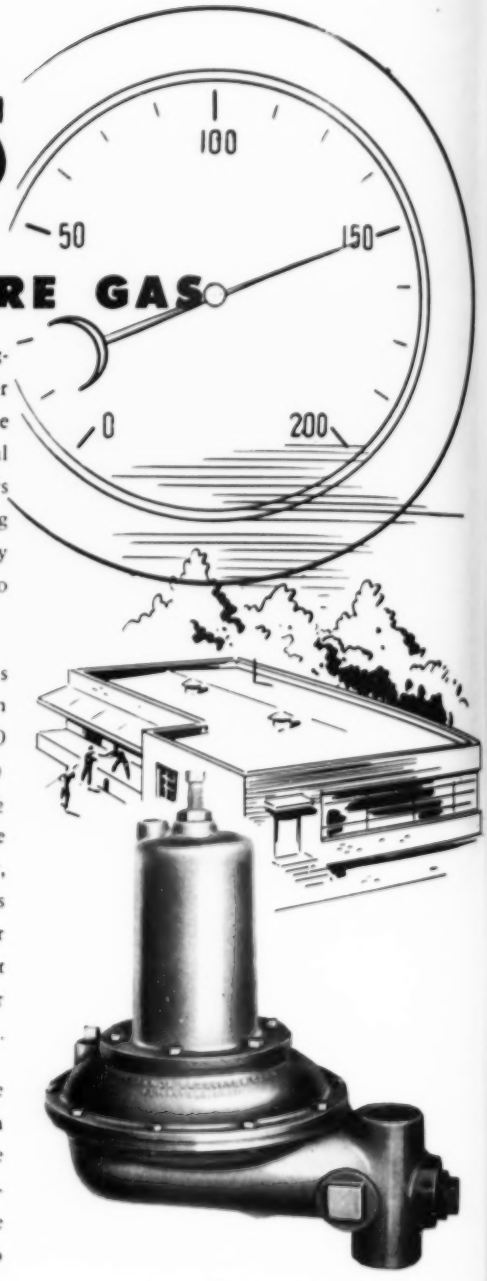

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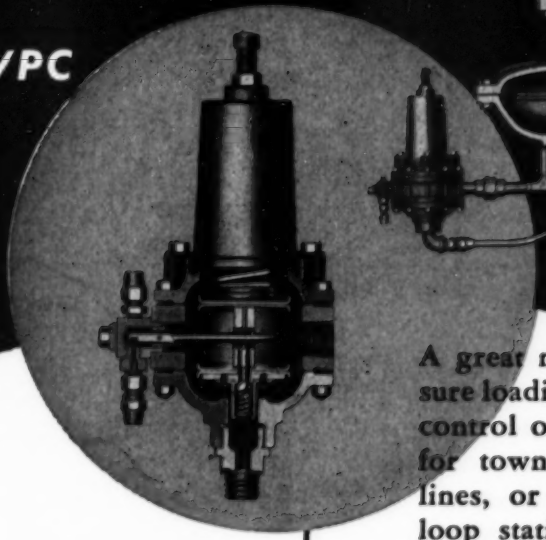

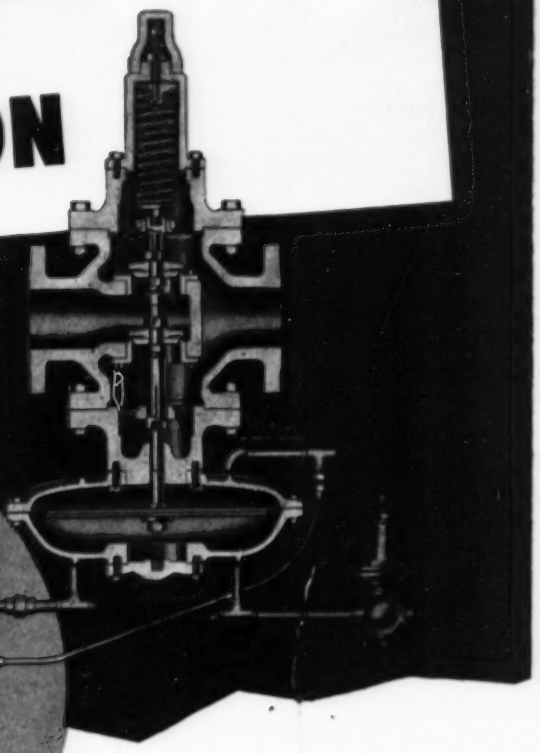

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GAS

31ST YEAR OF PUBLICATION

IN THIS ISSUE . . . .

When you begin storing gas in a field that is located in a highly desirable residential section, you are bound to run into plenty of local opposition—that is, unless you practice the good-neighbor policy. Even compressor stations can be welcomed in a fine neighborhood if the right approach is used (see the pipeline cover in this issue).

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GAS Thermally Thinking

Coats off for what?

ANYBODY here who subscribes to *Fortune?*

Just for the possible edification of those who don't, there was an article in the June issue about Servel and how its new management is endeavoring to scrape what's left of the company up off the carpet. And how, at the very last minute when it couldn't have been moribunder, a group of utilities dashed to the rescue with the requisite pint of Type A.

The statement was made that the utilities in general, up to that time, had not been exactly helpful. In fact, it was rather strongly intimated that they were enjoying Servel's discomfiture—indeed, they appeared to be cutting off their noses to spite their faces.

Now we don't really need the word of an outsider—not when our own AGA president makes the blunt charges he has been making on the podium in recent months. For example, at Southern Gas Association he said (speaking of air conditioning):

"Utilities, in their own interests, owe their sales and promotional support to these manufacturers to help develop new gas air conditioning units with advantages either of low first cost or low operating costs. In any event, we in this industry who stand to gain so much by offsetting present heating loads with cooling loads must not suppose that we can sit complacently by and have the results handed to us . . . if we were really on our toes we could do so much more to sell what air conditioning equipment is already available to us—if we would quit complaining about negatives and make up our minds to *sell* advantages for a change."

And again—

"If we ever needed to unite as a whole industry on any one thing it is to unite this year, right now, behind Servel's new program. We need Servel and Servel needs all of the one-time support, sales campaigns, field selling, sales ingenuity which it formerly enjoyed . . . forget past differences with Servel, and give your best to its promotion . . ."

From another quarter, there is the admonition of Tom Arden, president of GAMA, that "a tremendously better job of appliance merchandising must be done." His allegations can hardly be written off as the product of a prejudiced appliance salesman—not when they are so firmly substantiated by manufacturers' profit and loss statements.

Let's harken to another outsider—the editor of a dealer magazine:

"Against (electricity) the fight is being led by a frightened gas utility industry which seems paralyzed by the rapid advances of its adversaries. (Wow!) Though collectively the industry talks and plans on a broad and constructive scale, its individual utility units appear to be more interested in preserving their hoary dignity than in preserving their markets. Most of the 1100 autonomous principalities that make up the 'gas industry' somehow view their problems and their markets as different from all the rest. The excellent market-building material which they compile collectively too often is discarded by the individual utility as non-applicable to its particular situation. . . ."

There you have it—four expressions of opinion from persons interested and disinterested—a man from within the ranks, two allies, and a "third party." They are, thank goodness, no more than opinions. But here's a solid fact: subscriptions to the widely regarded PAR fell nearly a half million short of the goal in 1954. And while the total contributions in the 10 years of PAR's existence have risen from $1.55 million to $2.22 million, inflation has increased operating expenses almost proportionately—and this greater financial support . . . was provided by fewer and fewer companies representing an even smaller proportion of total industry meters."

That is fact, not opinion.

What does it all add up to? "Coats off for action?" Or a growing sense of futility?

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Time and the future will reveal many wonders...

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Throughout the nation, records show that over sixty American cities still use cast iron water and gas mains laid more than a century ago. No pipe can match cast iron's demonstrated longevity. And today, U. S. Pipe, centrifugally cast, is even stronger, tougher, more durable.

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highlights

GAS — SPOT NEWS, TRENDS, COMMENT ON GAS INDUSTRY AFFAIRS

Commerce department verifies it: utility spending skyrocketing

Expenditures for new plant and equipment are once more on a strong uptrend in the Commerce Department's indexes. From first-quarter expenditures that were well behind 1954's, the second quarter began a sharp comeback that placed it $64 million ahead of the same quarter last year and almost pulled the first six months even with 1954. (Totals for the six months were $2050 million for 1954, $2030 million for the current year.) Estimates for third quarter outlays place spending at a $1279 million rate, well ahead of 1954's $1060 million for the same quarter. "Seasonally adjusted," such an expenditure would be at an annual rate of $4.77 billion, which would be the second highest quarterly rate in history. Business in general is budgeting for expansion on a comparable basis.

Rayburn called key to Gas Act amendment question

With the Harris bill now on the House floor by virtue of a narrow approval in committee, Washington observers are looking to Speaker Sam Rayburn of Texas to carry the brunt of the battle to push it through. The Senate, it is conceded, will report a similar bill out of committee—maybe Fulbright's—and pass it if the House does. If the House does not pass it, there would be no incentive for the Senate to approve the bill. (For Harris bill, see page 129.)

Harris resolution seeks transmission-distribution probe

On the basis that the "pots have been calling the kettle black," Rep. Oren Harris, Arkansas Democrat who authored the proposed Natural Gas Act amendment, has asked the House to launch an investigation into practices of transmission and distribution companies. He wants to know where the other 90% of the money the ultimate consumer pays goes—over and above the 10% that is paid to the producer, he says. (See page 128 for details.)

Gigantic Mississippi span nears completion

Texas Illinois Natural Gas Pipe Line Co.'s magnificent twin-30-in. suspension crossing of the Mississippi river at Grand Tower, Ill., is just about ready to carry gas. Some facts and figures: length of span, 2150 ft; total capacity, 500 MMcf per day; pressure, 850 psi; tower height, 266 ft.

Westcoast's gas export moves step nearer to actuality

Biggest news in the northwest picture, where progress was being made on several fronts last month, was the Canadian government's action on behalf of Westcoast Transmission Co. In Ottawa, officials okayed a tax remission scheme which allows Westcoast a reduction of 60% in the import duties on all machinery and equipment not made in Canada. Estimated savings to the company: $7 million. A new Electricity and Fluids Exploration Act has also been written, and at such time as it is proclaimed as law, Westcoast will seek a new export permit. The company's present permit was issued under the old law, which contained revocation and export tax clauses on which FPC based a large share of its original Westcoast application.

AGA mat service casts utility in community role

"Gas Serves You and the Community, Too" is the theme of the new AGA mat service, the first six of which were just released. The ads stress the company's triple role as a gas-producing tax-paying community citizen; as the supplier of low-cost but premium fuel; as a dynamic part of the American system.

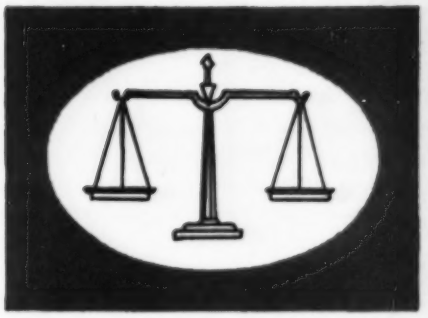
A-boilers for year-round air conditioning?

The Institute of Boiler & Radiator Manufacturer's general manager, R. E. Ferry, predicts year-round comfort conditioning with a baby nuclear reactor "within a few years." A single charge of fissionable material would heat and cool a home for six years at a cost estimated at $300, using a multiple-shielded "portable" reactor, he prophesied.

Building boom to continue, declares FHA commissioner

Commissioner Norman F. Mason assured members of I-B-R that the present rate of 1.3 million homes per year will continue. The total mortgage debt is not too high—it's "not as high in proportion to our spendable income as it was in 1939," he said. From 1946 to 1954, "only" 8.6 million new homes were built despite the formation of 9.3 million households.

*regulatory and legislative trends



Utilities may be reimbursed for relocation costs caused by highway construction

CONGRESS is working on a multi-billion dollar highway construction program, which will result in the expenditure by utilities of millions of dollars to relocate facilities. Utility spokesmen have presented convincing reasons to the Senate and House Committees on Public Works for reimbursement to utilities for relocation costs resulting from Federal-aid highway construction.

Utilities seek equity

The gist of the utilities' appeal was presented by Consulting Engineer Edward Falck to the House Committee in May. He testified that:

"All of these electric and gas companies have constructed extensive and complex systems for the transmission and distribution of utility services. Their facilities, both underground and overhead, are located along or across public streets and state and federal highways. In recent years, the construction of improved highways, expressways and freeways has required these utilities to remove and relocate parts of their transmission and distribution facilities. Such relocation of utility facilities has been at great cost, all of which has been borne by the utilities themselves. They have not been reimbursed for any part of these relocation costs. Ultimately these costs become a part of the total utility cost of service and must be charged to the rate payers. In short, the utility relocation costs due to highway construction are ultimately borne by the electric and gas consumers. We feel that this is not an equitable result. The full cost of highway construction should be paid by the people who benefit from improved highways or should be charged to the people who are using utility services.

"This problem, although important to the utilities in the past, is likely to become an increasingly serious problem with the proposed acceleration of federal-aid highway construction. There is no direct or indirect relationship between the benefits and costs of highway construction on the one hand and volume of use of utility services on the other. A large user of electric or gas service might make little or no use of the highways. Conversely, a person making frequent use of the highways might turn out to be a relatively small user of electric and gas services. The same, of course, is true with respect to other utility services such as telephone and water.

In favor of expansion

"The utilities are very much in favor of the expansion and improvement of the nation's highways. They believe that such expansion is definitely in the national interest and will contribute to the national defense and the general economy. However, they feel that in this enlarged federal-aid highway program a provision should be made for reimbursement to utilities for the cost of relocating their facilities. Such a reimbursement provision would allocate the cost of utility relocation to the place where it belongs, namely the highway project. This clear recognition and assignment of the cost of relocating utility facilities would provide an incentive for highway planners to select improved highway routes and engineering designs that would minimize the number, extent and cost of relocation. Since these costs are a component part of the total cost of highway improvement, regardless of who may pay for them, they should be given serious study at the time a decision is reached as to which is the best of several alternative routes and designs. This is sound engineering economics. In a number of cases, a change of route of only one or two blocks would have resulted in a material reduction in the size of the utility relocation job. In other cases a design calling for an elevated expressway instead of an underpass would have substantially reduced the cost of relocating utility facilities. By including relocation costs as a part of the total cost of the highway project, the engineering planning will inevitably result in the most efficient and least costly solution. This is worthwhile not only as a matter of equity but from the standpoint of obtaining the most economic overall costs for the benefit of our national economy.

"Congress has long recognized that the cost of relocating railroad facilities should be considered a part of the construction cost of a federal-aid highway project. All that we are recommending here is that utilities be treated in the same way as railroads. We therefore respectfully recommend that your committee give favorable consideration to the principle of authorizing reimbursement to utilities for the cost of relocating their facilities when such relocation has been made necessary by the federal-aid highway construction program."

Senate committee is favorable

The Senate Committee on Public Works amended the Gore bill (S. 1048), and recommended reimbursement for utility relocations. That committee declared:

"The problem has been before the committee for several years. In the Fed-

*A monthly commentary on national and state developments by an expert in the field of utility law.

Regulatory Trends... Gore bill provided for 50% reimbursement of relocation costs

eral-Aid Highway Act of 1954, the Secretary of Commerce was directed to make a study of the problems posed by necessary relocation and reconstruction of public-utility services resulting from highway improvements. The study included a review and financial analysis of existing relationships between the state highway departments and affected utilities of all types, and a review of the various state statutes regulating existing relationships. The utilities cooperating on the study reported their investigations of highway construction with a dollar value of $1.1 billion, had a utility relocation cost of $35.5 million. The relocation cost involving utilities located within the highway rights-of-way amounted to $29.1 million, of which only $3.8 was reimbursed. The report is published as House Document 127, 84th Congress.

"The committee recognizes some merit in the claims of the utility companies, and the inequity that exists in the assessment of utility relocation costs under present conditions. It appears that such inequities as may exist arise largely because of the relationships between the utilities and the state and local governments which own or control the highway rights-of-way.

State practice

"Most of the states reimburse utilities for relocation costs occasioned by highway improvements when the utilities are located on their own private rights-of-way. Under existing Federal-aid law, the federal government can and does reimburse the states for the federal matching share of the cost of construction of federal-aid roads. If the state, pursuant to its own laws and regulations, can and will certify that utility relocation expense is a proper charge to the construction cost of a highway, that expense is included in the total construction cost for which the state is reimbursed by the federal government to the extent of the federal share. If the state is unable or unwilling to certify utility relocation expense as a proper charge to the highway construction cost, no federal funds may be applied toward meeting the relocation expense.

"The committee feels that there is some justification for reimbursing utilities for a portion of their cost of relocation in states where under the laws or practices of the state in which the project is being constructed the entire relocation cost is required to be borne by the utility. It is recommended that 50% of such costs may be paid from federal funds, provided that no more than 2% of all sums apportioned to any state for any fiscal year for expenditure on the federal-aid systems may be expended for such purposes. The salvage value of the old facility, and the increase in value or betterment derived from the new facility, will be properly credited when arriving at the cost of the relocation. The Secretary is authorized to make such payments based on agreements entered into between the state highway department and the utility, containing an estimate or agreed cost of relocation.

Committee's intention

"It is the intent of the committee that these provisions shall apply to any concern engaged in the utility business, without regard to the form of its organization, and whether publicly, privately, or cooperatively owned. It is the further intent that these provisions shall not limit the right of utilities to receive reimbursement for relocation costs in those states which by law or by practice already provide for such reimbursement."

On May 25, 1955, the Senate passed the amended Gore bill providing for a five-year, $18 billion highway building program, and the federal payment of 50% of relocation costs.

Objectives of the highway legislation

Congress has declared that it is in the national interest to accelerate the construction of federal-aid highways, because many highways are inadequate to meet the needs of local and interstate commerce, and the national and civil defense.

The Senate-approved Gore bill providing for a five-year program of federal-aid to interstate, primary, secondary, and urban road systems is short of President Eisenhower's 10-year highway construction plan. He expects better cooperation in the House of Representatives, with a proposed bond issue to help finance construction. The Gore bill would add to the national deficit unless new revenues materialize. One expected move is an increase in the federal gasoline tax.

Largest program

The 1954 Federal-Aid Highway Act, which authorized funds of nearly $1 billion for the fiscal year 1956, was the largest program in history for modernizing highways. These highways further the national economy, as well as promote national and civil defense. Early authorization for the fiscal year 1957 and the future will permit advance planning by the states and arrangements for financing required to match the federal funds.

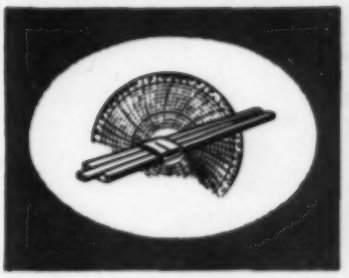
Almost every witness who testified before the Congressional committees recommended an expanded highway program with emphasis on completion of the 40,000-mile network of superhighways to connect all parts of the United States.

The number of vehicles and the mileage travelled on our highways have maintained a steady upward trend since World War II. In 1946 there were 34½ million motor vehicles on the highways. Today there are more than 58 million. By 1965 the total is expected to be 81 million. Improvement of the nation's highways is lagging. The highways are deteriorating and becoming obsolete. Traffic demands far exceed the capacity of the highways being provided under the existing program. The estimated necessary expenditure for federal-aid highways is $68 billion, with a total highway need of $101 billion for the nation.

An adequate highway system is vital to the United States. To provide a sufficient system will require vast increases in expenditures for highways. The public will become aware of this need, and demand action.

It is a good bet that the future cost of relocating utility facilities to accommodate highway construction will be a staggering amount. The future financial health of many utilities will become poor, unless the federal doctors prescribe reimbursement for the expense of relocating facilities. ■

technical trends



• By GUY CORFIELD

Automation

The recent developments and applications of instruments and automatic controls, referred to as "automation," have caught the fancy of industry and general public alike to a degree hardly exceeded by nuclear power and supersonic flight. Automation is regarded with fascination, and with emotions varying all the way from apprehension to anticipation. As one writer has put it, the current articles appearing in newspapers, scientific journals, and business magazines "picture the age of automation, on the one hand, as a scientific-fiction type civilization with robots running machines and tragic unemployment; on the bright side is the concept of a Utopian society, with unlimited supplies and everyone spending most of his time in comfortable leisure, perhaps working one day per month; as usual, the truth lies somewhere in between."

The original definition of automation, by D. S. Hurder, vice president in charge of manufacturing of Ford Motor Co., was "the mechanized handling of materials," and this was later expanded to include "both automatic operations and the process of making things automatic." A recent definition proposed by the technical editor of the magazine *Instruments and Automation* is "the substitution of mechanical, pneumatic, hydraulic, electric and electronic devices for human organs of decision and effort." One can trace through these definitions the broadening of the concept and the entry of the computers (electronic devices reputedly capable of lightning speed and human-like decision) into the picture. As in other new fields, a special vocabulary or terminology has been adopted, and Brown Instrument Division of Minneapolis-Honeywell Regulator Co., Philadelphia, has developed a 20-page "Automation Dictionary" defining the various terms used. All this has not produced anything near hysteria but it is worrying many people including national labor. Labor appears to recognize that automation will create new jobs when it eliminates old ones, but fears that the new jobs will require higher skills and wants to be sure that industry will retain the workmen and train them to these higher skills when the time comes.

Automation is, of course, most frequently thought of in connection with plants and factories, and descriptions of such are written with attention focused on a control room with banks of instruments and two or three white collar attendants, and intimation that the plant practically runs itself. Actually this is seldom the case, even though instruments are taking over more and more duties. At the present stage, at least, there are both problems and limitations. Care must be exercised to keep the production line balanced so that one part does not perform faster than another. It can be observed, even in modern plants with hundreds of automatic machines, that some of them are hand-fed or are interspersed with humans performing assembly jobs, and interruptions from human fatigue, sickness or absence must be considered. Again, in this rapidly changing industrial age, the factory should not be so mechanized with specialized machines and controls that it cannot be changed over to a redesigned or new product without prohibitive expense. It would appear also that, as a plant becomes more nearly automatic, it will be more at the mercy of the instruments. Breakdown of controls for electrical or mechanical reasons will become more serious, with increasing dependance on a specialized maintenance staff.

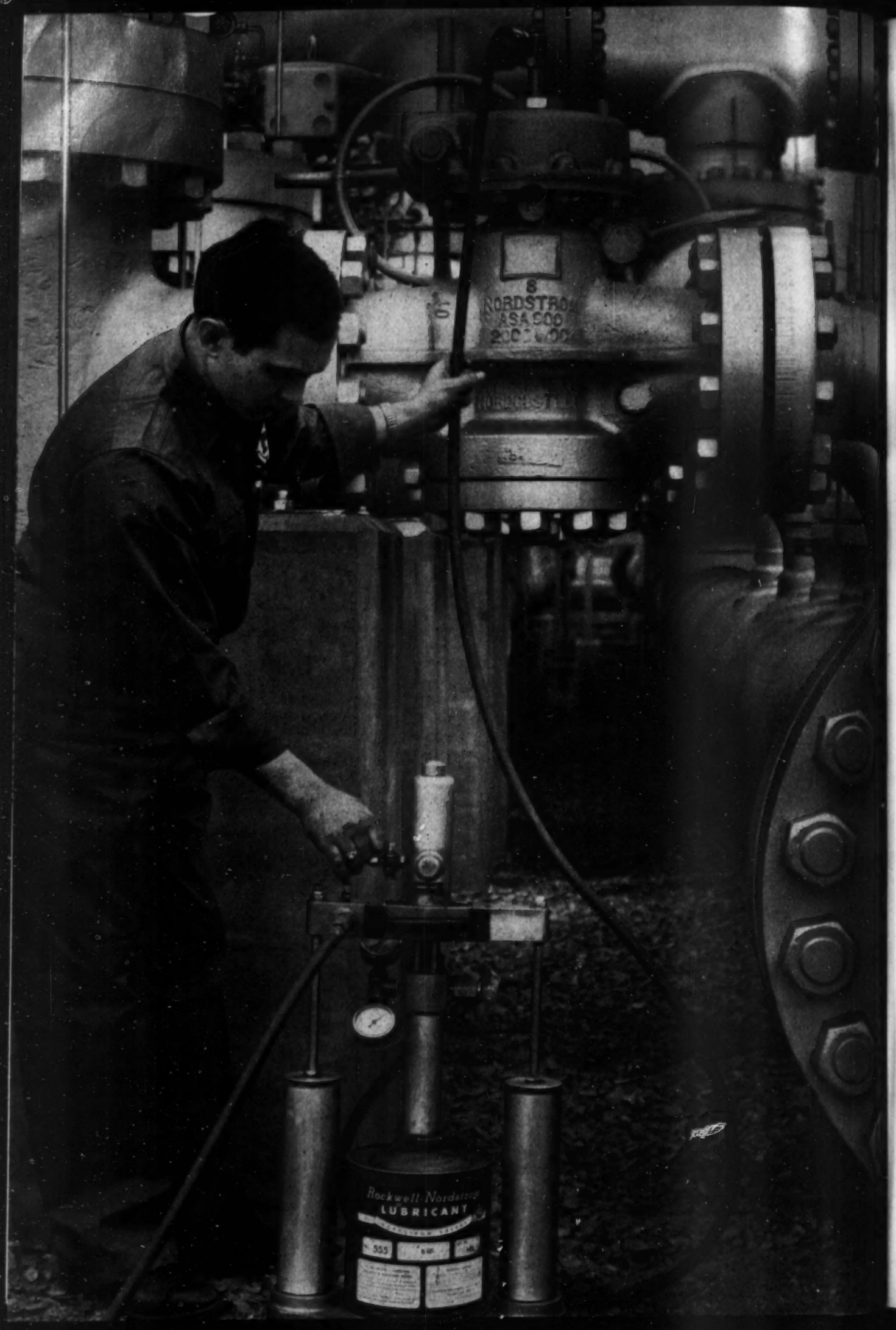
Automation (perhaps not recognized as such) is already well established in the gas industry with the use of pressure regulators, telemetering and remote control, automatic valve operators and positioners, integrating flow meters, digital computers, etc. Manufactured gas and petrochemical plants, compressor station, and appliance and accessory factories, will no doubt become more and more mechanized. While gas operations in general may not be as amenable to extensive automation as many others, new developments and applications are sure to follow if the industry remains receptive and resourceful.

Odorization in reverse

Ordinarily, natural gas operators think of odorization as being used to impart an odor to natural gas, but actually the odor industry is as much concerned with deodorizing, or masking, hiding, changing or neutralizing odors, as it is in producing them. Deodorization is principally accomplished by creating a different and more pleasant odor, although in some instances the odor can be very much reduced and even substantially neutralized or eliminated.

Several firms have developed deodorizing or masking formulas: typical are Fritzsche Brothers' Neutroleum Alpha and Neutroleum Gamma, Sindar's Deodall No. 1, and DuPont's Alamask. One ounce of Neutroleum Alpha is said to deodorize 50 gallons of fly spray, and Deodall No. 1 at a concentration of 0.001 to 0.01% is claimed to deodorize fish oil or heating oil.

In the gas industry there has been occasion to try to neutralize drip oil or odorant, and in one instance Neutroleum Gamma was successfully used in an apartment house to convert the odor of spilled odorant into a typical household smell similar to perfumed detergent, toilet soap, etc. With increasing attention being given to air pollution, the art of odor control would seem to have considerable potential.


Rockwell-Nordstrom
LUBRICANT

Economic considerations of corrosion control on underground piping

—in two parts

GAS

JULY 1955

GAS exclusive

By A. W. PEABODY
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Hole-drilling operations for the installation of ground bed anodes.

1. Pipe materials, coating qualities vs. cathodic protection, and overall costs

THE corrosion engineer concerned with controlling leakage on transmission and distribution piping systems must always keep the need for economical practices uppermost in his mind if he is to give his company an effective corrosion control system at the least cost. Although there may be several technically satisfactory ways to stop corrosion on a certain section of a system, there must always be one way that is the most economical. It is our intention to review some of the more important economic considerations and to show how these considerations affect practical corrosion control problems.

The matter of materials used in the piping system itself is a logical starting point since large sums of money can be saved by proper material selection practices and installation procedures. If a piping system is to be made as nearly corrosion resistant as practicable with coating supported by cathodic protection, the design engineer can first look to the amount of steel needed for a particular project to see if he can safely reduce pipe wall thickness. In most modern transmission line construction, only enough steel is used in pipe to meet strength requirements without providing extra thickness for corrosion resistance. In distribution systems, however, standard pipe sizes commonly used have thicker walls than are needed for strength. In the usual distribution systems, wall thickness can safely be reduced if adequate corrosion control is made a part of the completed installation project. In one report[1] on the corrosion control experience of two gas distribution systems, weight reductions ranging from 7% to 40% are cited with an average of approximately 20%.

If, for example, a complete distribution system requiring 10 miles of 3-in. equivalent pipe is planned for a small town and would require 200 tons of

steel using standard pipe sizes, a 20% reduction in weight by using thinner wall pipe would save 40 tons of steel worth about $5600 (at an average cost of $140 per ton fob mill) in addition to savings in freight costs and intangible savings from greater ease in handling the lighter material.

For corrosion control on this sample system, a coating with cathodic protection could be used. Coating costs vary but approximately $6000 should provide a good standard coating that will restrict cathodic protection current requirements to a small value. Cathodic protection can be provided on new distribution systems at a cost approching 1%, or less, of the total construction budget. For this sample system, $1200 would represent a reasonable figure allocated to cathodic protection if applied when the distribution system was built.

If the distribution system were built with standard weight pipe and given a coating and cathodic protection, the cost of protection would be $6000 for the coating plus $1200 for cathodic protection, or $7200. If advantage were taken of the ability to use lighter weight pipe or. a properly protected system with a saving, in this case, of $5600 in the cost of pipe steel, the net cost of corrosion protection would be only $1600 since all but $400 of the $6000 cost of the coating is offset by the saving in steel cost. The $1600 net cost represents approximately 3 cents per ft of 3-in. equivalent pipe to make this sample distribution system essentially corrosion free.

Differences

It is realized that economic comparisons may differ from company to company and even between divisions of one company so that no strict conclusions can be drawn here. The foregoing example does, however, illustrate one of the economic considerations that should be taken into account. Other economic comparisons follow and will tend to further illustrate how to take proper advantage of corrosion control methods and techniques that will result in the lowest over-all cost without sacrificing system performance.

The development of the best combination of cathodic protection and pipe coating for a particular system is subject to careful economic analysis by any corrosion engineer since the proper interpretation of his analysis of this problem can involve large savings—or, if the interpretation is faulty, unnecessarily high annual system costs. This necessity for good economical (as well as technical) judgment in selecting a protection system is as important on the smaller projects as on the larger ones, although in the latter case, the sums gained or wasted may be quite impressive. There are proponents of many corrosion control combinations ranging from cathodic protection plus electrically poor coatings (or none at all) to cathodic protection plus the electrically and mechanically best coating available. Although only economic factors will be considered here, the best practical combination is not always based entirely on economic comparisons since there are often other factors applying to a particular project that will affect the decision.

There is no intention to discuss types of coatings here other than to emphasize that when selecting a coating for a proposed piping project, it is most important to consider those that are the more reliable from the standpoint of stability —which means maximum resistance to soil stress and deterioration because of attack by soil components plus freedom from marked reduction in electrical resistance with time.

CORROSION CONTROL COSTS OF A SAMPLE SYSTEM:

Item	Type of Cathodic Protection
Applied cost of coating (expressed in percent of estimated cost for 25,000 ohm/sq ft coating)	—
Installed cost[3] of cathodic protection (expressed in percent of cost for rectifiers on bare pipe)	Rectifiers
	Anodes
Annual costs[4] for operating and maintaining cathodic protection (expressed in percent of costs for rectifiers on bare pipe)	Rectifiers
	Anodes
Total annual costs[5] for cathodic protection (expressed in percent of costs for rectifiers on bare pipe)	Rectifiers
	Anodes
Total annual costs for cathodic protection (expressed in percent annual fixed charges on coating investment)	Rectifiers
	Anodes
Total annual costs[6] for coating and cathodic protection (expressed in percent of costs for rectifiers on bare pipe)	Rectifiers
	Anodes

General note:
This table is based on a specific example as stated in the text and does not necessarily represent average conditions. For any actual system, comparisons must be made on the basis of costs and conditions applying to that system.

[1]See text.
[2]Poorly applied coating of better quality or better coating allowed to deteriorate with time before application of cathodic protection.
[3]Based on cost of material and contract installation plus all engineering costs for locating

Relative estimated costs on 100 miles of 20-in. pipeline in soils of 5000-ohm-cm average resistivity (Table 1)

Relative Estimated Costs[1] for Coatings of Various Electrical Resistances

Bare Pipe	10,000[2] ohms/ sq ft	25,000 ohms/ sq ft	50,000 ohms/ sq ft	100,000 ohms/ sq ft	200,000 ohms/ sq ft
—	132%	100% Base	132%	146%	179%
100% Base	5.29%	3.18%	2.76%	1.91%	1.48%
234%	27.2%	12.5%	6.29%	3.33%	2.00%
100% Base	14.3%	8.07%	7.62%	4.88%	4.51%
35.6%	8.55%	4.88%	3.30%	2.62%	2.27%
100% Base	10.0%	6.74%	5.31%	3.46%	3.06%
130%	17.9%	8.76%	4.84%	3.02%	2.18%
—	10.7%	8.10%	5.66%	3.33%	2.42%
—	19.2%	12.3%	5.17%	2.90%	1.71%
100% Base	102%	76.7%	99.1%	107.7%	130.3%
130%	112%	79.6%	98.6%	107.1%	129.4%

installation sites, designing installations, supervising construction, adjusting completed system, and making cooperative tests at foreign pipeline crossing.

[4]Based on power costs (rectifiers only), labor and materials for repairs, periodic checks on all installations and annual line potential survey (except for distributed anode systems on bare pipe which will be surveyed at five-year intervals).

[5]Based on annual fixed charges on cathodic protection investment plus annual costs for operating and maintaining cathodic protection system.

[6]Based on annual fixed charges on coating investment plus total annual costs for cathodic protection per Note (5).

In comparing coatings from the corrosion engineer's economic viewpoint, the comparison must be made between the cost of coatings having higher electrical resistance and the reduction in cost of the cathodic protection system resulting from the use of the electrically better coating. There is no practical object in considering the use of the more expensive of two coatings having the same electrical strength unless the more expensive coating has better stability—and if the latter is true, it can be worth more than the initial cost premium for the more stable coating. Determining the average electrical strength of any particular type of coating for comparative purposes may be difficult, but if a sufficient amount of each type of coating is available in the investigator's system or in other systems from which data can be obtained, useful average figures can be procured provided that all coating resistance measurements are made by some uniform method[2] and provided that sufficient weight is given to such factors as age, soil conditions (including average resistivity), and installation conditions when making the comparisons.

As a means of studying the economic balance between coatings and cathodic protection as well as other matters to be taken up later in the article, we can assume that we are corrosion engineers faced with the problem of providing adequate corrosion control of 100 miles of 20-in. pipeline soon to be constructed in soil of 5000 ohm-cm average resistivity. This pipeline will cross 25 pipelines of other ownership. The experience of all pipeline owners in this general area has shown that corrosion is a serious problem unless mitigative measures are taken.

Bare or coated

As our first economic study on this sample system, comparisons can be made between the cost of cathodically protecting this line if bare and the cost of protecting it if provided with coatings having resistances of 10,000, 25,000, 50,000, 100,000, and 200,000 average ohms per square foot. These resistances are not those that will be obtained when pipe is first coated but are those that will be maintained through the normal economic life of the pipeline. Although it cannot be expected that the costs that will be used will agree with all readers' experience or beliefs concerning the various items, I have attempted to use figures that are reasonable and based on experience so that any deductions made from them will show a trend that can be checked for any particular piping system by using cost figures directly applicable to that system.

Table 1 contains comparisons showing the results of cost calculations covering coating and cathodic protection for the sample system. It will be noted that applied costs for coatings of 25,000, 50,000, 100,000, and 200,000 ohms per square foot resistance are given in terms of the cost of the 25,000 ohm coating as 100%. The relationship between coating resistance and cost can never be absolutely fixed and the actual coating resistance obtained with a particular coating combination can vary over a wide range depending on environment, soil stress, and application conditions and methods. For the purpose of this article, the four coating combinations used were assigned coating resistances considered reasonable for comparative purposes. It is recognized that in areas of severe soil stress, it may be necessary to apply the best available coating combination in order to maintain stable coating resistances of the lower values. The four coating combin-

Corrosion control... It is economical to spend money to attain maximum electrical resistance

ations range from unreinforced pipeline enamel to a double layer enamel coating reinforced with glass mat and asbestos wrapper.

The cathodic protection cost relationships shown in *Table 1* are based on recent cost figures for materials and contract installation. The rectifier protection systems are based on the use of a sufficient number of installations to avoid unnecessarily high protective potentials at the rectifiers (limited to —1.2 volt to copper sulfate electrode on coated pipe in this case) in order to insure a maximum coating preservation effect from the cathodic protection system.

The galvanic anode protection systems are based on the use of appropriately spaced groups of magnesium anodes except for protection of bare pipe where a completely distributed anode system is used.

Rectifier installations for bare pipe are based on an assumed average cathodic protection current density of 1 milliamp per square foot of pipe surface; this figure assumes new unpitted pipe that will be protected soon after laying. Since distributed magnesium anodes can furnish protection at substantially lower average current density than rectifiers on bare pipe because of the relatively very closely spaced current sources, this factor was taken into account when calculating the current requirement for this comparison. If this pipeline were installed in lower resistivity soils, the current requirements for cathodic protection of bare pipe could be greater and, in very low resistivity soils, could easily result in protection system annual costs double or more the figures used in formulating *Table 1*. Although on coated pipe the effective resistance of the coating varies with the soil resistivity and will affect cathodic protection costs, the percentage change in the total annual cost of coating plus cathodic protection will be small since it will be noted from the table that fixed charges on coating investment are the controlling factor rather than annual cost of cathodic protection. The comparison demonstrates that the annual cost of cathodic protection is a small percentage of the annual charges on coating investment and that this percentage becomes progressively smaller as the coating resistance increases. If the cost comparisons made in *Table 1* had been made on the basis of 1000 ohm-cm soil rather than 5000 ohm-cm soil, the cost advantage of cathodically protected coated pipe over cathodically protected bare pipe would have been much greater.

Fixed annual charges on capital investment were estimated on the basis of a 20-year equalized return period, actual expected life of the various installations, and consideration of rate of return on investment, average rate of interest on debt, ratio of debt to capitalization, income taxes, ad-valorem taxes, and insurance costs. Any corrosion engineer making cost comparisons should accurately determine the annual fixed charges on capital investment used by his company since a few percent difference in the rate used can make a substantial difference in deductions obtained from a cost comparison.

In *Table 1*, the final comparison shown opposite "total annual costs for coating and cathodic protection" indicates that based on costs for bare pipe as 100%, the combination of cathodic protection and the cheapest coating used in this example gives the most favorable over-all annual cost on the basis of the figures used. This can only be true if the cheaper coating is stable over a long period of years. If it is not stable, it may be necessary to add supplementary cathodic protection after a few years to take care of the increased cathodic protection requirements. This is illustrated to some degree by the cathodic protection costs included in *Table 1* for a coating that has deteriorated to a resistance of 10,000 ohms per square foot; it will be noted that the total annual cost of cathodic protection and the 10,000 ohm per square foot deteriorated coating is somewhat higher than the annual cost for cathodic protection alone for bare pipe under the conditions of this example.

In *Table 1*, the cheapest coating shown is an unreinforced enamel, which is generally acknowledged to be unstable (subject to soil stresses, etc.) except under ideal conditions. Experience has shown that a reinforced coating is necessary for the usual pipelining projects. Justification for the more expensive coatings is based on the necessity for having more highly reinforced coatings to give stability in areas where soil action on coatings is particularly severe. The general deduction, then, is that the most economical protection combination is cathodic protection plus the cheapest *stable* coating assuming that an accepted pipe coating material with good electrical strength is used.

In addition to the more obvious economic considerations, there are additional advantages to cathodically protecting coated pipe versus cathodically protecting bare pipe. First in probable importance is the matter of degree of protection obtained. On bare pipe it can be extremely difficult to be sure that corrosion has been stopped at small local cells on the pipe surface as very active cells of this type can exist even though the general level of protection may be good. With coated pipe installed with the usual care, a strong local cell having adjacent anodic and cathodic areas will seldom be exposed at a single coating holiday while corrosion between anodic and cathodic areas exposed by different holidays (as is the usual case) is easily overcome by cathodic protection and test procedures indicating this condition are relatively positive. In congested areas, the problem of possible interference between current from a cathodic protection system and foreign pipelines is far greater for a cathodically protected bare line than it is for a cathodically protected coated line—and on protected coated lines, the higher the electrical resistance of the coating is, the less chance there is of interference damage provided all ground beds are properly located.

The corrosion engineer having a specific system to protect must make his own comparative analysis including all the items shown in *Table 1* plus any others that may be peculiar to his local conditions. Provided his basic data are reasonably accurate, he can then compare the over-all annual costs of cathodic protection plus each of the various coating combinations and select the most economical combination that will result in stable system operation.

Although it might be apparent from the cathodic protection cost comparisons included in *Table 1* that there is relatively little difference between the cost of cathodically protecting a normally good coating and that of cathodically protecting a normally better one, it is nevertheless economical to spend money

to attain the maximum electrical resistance of which any coating used is capable. If a piping project is coated in the field without electrical testing, satisfactory installation specifications, and adequate inspection, it is easily possible that the initial cost of cathodic protection for the coated pipeline will be twice, or more, that which would have been required if the pipe had been coated and lowered in with proper specifications and supervision.

Using the 100-mile example pipeline with a nominal 50,000 ohm per square foot coating as a working base, assume that the coated pipe was put in without suitable inspection and that because of this the coating condition in place was such that the installed cost of cathodic protection was twice (and this is entirely possible) what would have been required for properly coated pipe. The additional investment for cathodic protection (above that normally required) would have a certain annual cost depending on the fixed charge rate. In addition to this, the larger cathodic protection system required for poorly coated pipe would have higher annual costs for operation and maintenance. The total increase in annual cost for the larger cathodic protection system represents the maximum permissible annual cost of capital investment required to give the coated pipe proper inspection if inspection is to be economical. On the example pipeline, calculations indicate that the annual cost of the investment for inspection would be only approximately 80% of the estimated increase in annual cost of cathodic protection if inspection were not used and coating quality suffered accordingly. Inspection costs were based on the use of two spreads during pipeline construction, liberal construction time, one qualified coating inspector per spread, and one electrical holiday detector with operator per spread. Figures will, of course, vary for any particular set of conditions but it can normally be shown that it is economical as well as logical to spend the necessary money to be sure that a good coating is put on in such a way that the best practical performance of which it is capable will be attained.

The question of when to install cathodic protection is often raised with the problem being to compare the economy of installing cathodic protection at the time a piping system is built with the economy of waiting until leaks develop and then applying protection. The results of economic studies on this question depend on variations in factors involved; some of the more pertinent factors include operating pressure, value of product, spacing between valves, hazard to life and property from leaks, coating (if any), and accessibility to the piping.

Next month Mr. Peabody will cover rectifiers vs. galvanic anodes and other details of cathodic protection.

On high pressure gas transmission lines, the hazard from gas leaks is enough greater than on low pressure systems to make this factor alone sufficient justification for cathodic protection from the beginning. If pipe weakened by corrosion bursts under high pressure, just one such accident on the 100-mile, 20-in. example line that we have used could easily exceed the cost for cathodic protection (assuming coated pipe) in cost of property damage, gas loss, and repair work. Even where line ruptures do not occur (and ruptures resulting from corrosion are relatively infrequent on coated pipe), it is often necessary to reduce pressure on high pressure lines by taking a section of line out of service and blowing it down before the repair work can be accomplished. At a conservative cost of $1000 for each such leak (value of gas blown off, cost of repairs, and an estimated value of gas lost through the leak itself but assuming no property damage), it would take only four to eight such leaks to equal the installed cost of cathodic protection for the entire 100 miles of line although for every large corrosion leak requiring a line blowdown to repair, there will normally be several smaller leaks that can be repaired at smaller cost without reducing line pressure.

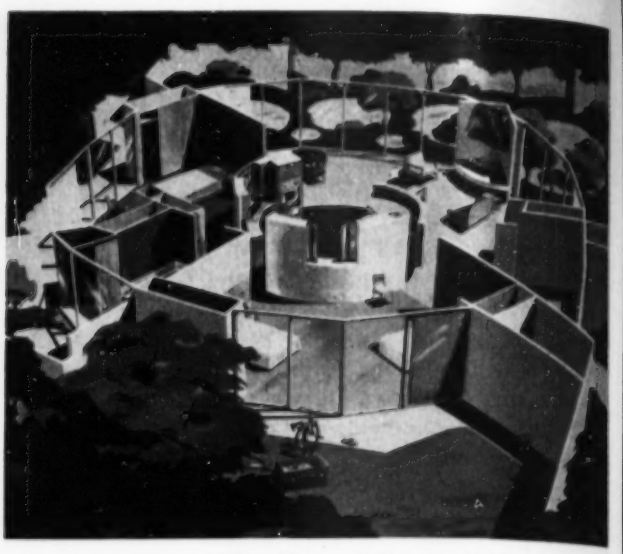
If a coated pipeline, particularly, is not cathodically protected until leaks have developed and if the period between construction of the pipe system and installation of cathodic protection is a matter of several years, the condition of the coating may have deteriorated to the point where a very appreciable increase in current requirements for protection will be noted, whereas if protection had been properly applied at time of construction, the cathodic protection requirements would be smaller and would remain smaller because of the tendency for properly installed and adjusted cathodic protection to preserve coatings by eliminating formation of corrosion products in coating pinholes and cracks. Without protection, the coating defects would be enlarged by the corrosion products and the current requirements for cathodic protection would gradually increase. Cathodic protection cannot reduce mechanical damage caused by soil stress. Stability in this respect is gained by selection of the proper coating combination to resist existing soil stress conditions.

In checking the economic effect of this action, it was assumed that the 100-mile example pipeline was coated with a nominal 25,000 ohm per square foot coating. For a 40-year pipeline life, the total costs were calculated for a cathodic protection system installed at the time the line was built and included the fixed charges on the investment plus operating and maintenance costs. This total is only about 74% of the total calculated costs that would be incurred if cathodic protection were not installed until leaks had developed. This indicates that, under the conditions of this example, there is a definite economic advantage if cathodic protection is installed early in a pipeline life.

In calculating the costs for the latter case above, it was assumed that cathodic protection was installed 10 years after the line was completed, that during that period 20 leaks costing an average of $250 each had occurred, and that by the time cathodic protection was applied the effective coating resistance had dropped to 10,000 ohms per square foot through lack of the preservative effect of cathodic protection.

In addition to the probable higher eventual total cost if application of cathodic protection is deferred, line operators following this course are risking the possibility of the high costs of extensive property damage, which are always possible if leaks occur at the "wrong places." The preceding comparison was based on the assumption that all repaired leaks were of the "cheap" variety—if serious property damage were incurred at even a very few of the leaks, the balance could be even more favorable to installation of cathodic protection at the time the line was built. ■

All-gas kitchen feature of circular house at California home show



Above is an artist's conception of the circular home, outstanding feature of the 10th annual southern California home show. At left is the circular kitchen—with Mrs. California (Kay Girvan) demonstrating the all-gas appliances.

AN all-gas kitchen was the heart of a revolutionary circular home at southern California's 10th annual Home Show. The central attraction of many exhibits in the vast Pan Pacific auditorium in Los Angeles, this "home with a heart" incorporated a circular kitchen composed of three unconnected islands.

The stone arc of one of these islands provided a backing for the gas refrigerator and the gas clothes dryer. Another island housed a color-matched, built-in gas oven and four top burners, and also served as the interior wall of the master bedroom. The interior border of the livingroom area is defined by a 4-ft stone wall, which serves as a bar and a pass-through from the kitchen. The sink and automatic dishwasher utilize the reverse side of the half wall.

Opening on June 9, the Home Show ran through June 19, during which time hundreds of thousands of persons, including more than 10,000 builders, architects, contractors and allied tradespeople, visited the exhibits of modern home construction and furnishings. Theme of the 1955 show was "The Great Show that Has Everything" and the theme was borne out by some 400 exhibits, from plaster, hardware and stone, to five completed houses.

Student designed model

Number 2 on the list of outstanding exhibits from the standpoint of gasmen was a contemporary two-bedroom house built by students of Pasadena City College. Sponsored by the Pasadena-San Marino Chapter of the Building Contractors Association and the Southern California Gas Co., the 1000-sq ft house featured a step-saving "New Freedom Gas Kitchen," designed by students in cooperation with the gas company's kitchen planning bureau. The kitchen measures 8 ft 3 in. by 12 ft 6 in. and a fully automatic copper-tone oven sets the style for the compact working area.

Basic shape

Designed in a basic "U" shape, the kitchen has revolving corner cupboard units, a built-in gas refrigerator, and a range that has top burners flush with the tile-topped counter separating the kitchen from the dining area. Completing this ultra-modern kitchen is a built-in counter-top water heater, an automatic washer, and a gas clothes dryer all arranged for the utmost efficiency.

Another highlight of the show was the Natural Gas Bureau's exhibit, which occupied nearly 1150 sq ft, and stressed the availability of choice in all types of gas appliances.

Wide range of selection in design, color, and placement was illustrated by six built-in oven and broiler units with companion counter-top burners, a complete all-gas display kitchen, a series of deluxe, free-standing ranges, and full-color transparencies of actual kitchens in many southern California homes. ■

Holyoke attacks high skip reading costs with domestic telemeters

Easy reading of the outdoor meter repeater mechanism (left above) may prove a substantial money saver for many utilities that have numerous indoor meter installations.

By **WILLIAM W. CLARK** • Editorial Director

A DRASTIC reduction in skip readings, which have been costing an average of $2.50 each, is anticipated by the City of Holyoke (Mass.) when it begins installing a large order of domestic telemetering installations this year. Over a two- and three-year period, the city's gas division will put about 400 of these repeater devices on customers' meters in selected locations.

They've proved themselves in extensive and punishing tests, according to D. M. Ballou, superintendent of the gas division, and should be a real asset in eliminating callbacks, estimated readings, and two-month bills.

The only difficulty Mr. Ballou envisions is the likelihood that all the company's customers will want one of the shiny, attractive gadgets. Because of their capital cost, the division wants to limit them to certain types of problem installations, so a runaway demand would be unfortunate for the division management. But even this problem will not be too serious, Mr. Ballou thinks: a "priority system" of sorts should dam up much of this demand until the novelty has worn off.

GAS survey

Load circumstances in Holyoke are generally favorable for domestic telemetering use. A highly industrialized town, it has a number of families in which both husband and wife work and are gone every day. Meter reading is a hit-or-miss affair. Skip readings in certain locales are frequently necessary. Furthermore, househeating has been catching on rapidly in recent years, and with the higher consumption rate, two-month bills in the wintertime are alarming to the consumer who more often than not forgets that he had no bill to pay the previous month. Reactions are liable to be unfriendly, as any gas company knows.

Thus, the 400 telemeters will initially go into newer homes where the younger families live, because it's there that the housewife is usually gone during the day, working to help pay for the place. Installations are being limited to locations where—

1. Gas is being used for househeating.
2. There is already an outdoor electric meter set in place.
3. Company records show poor experience in gaining entry for meter reading.

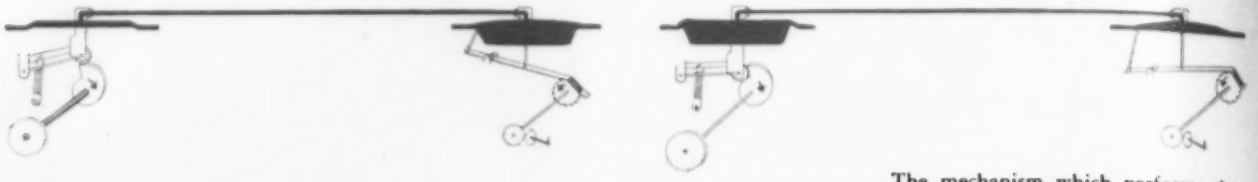
The telemetering sets, installed, cost between $14 and $16 each, so on a basis of strict economics, the frequency of skip readings, even at a cost of $2.50 each, must be of moderately serious proportions.

Holyoke has run into two regulatory difficulties in connection with the project. The state public service commission, which has rather rigid rules covering meters and metering practices, demands that the *meter* be read every month. Strictly construed, this requirement would seem to rule out the reading of *repeater mechanisms*. However, an exception has been made to this rule—and, conceivably, the rule could be rewritten at some future date—permitting the reading of the telemeter monthly with a check reading of the meter itself twice a year.

This arrangement works out nicely for the utility, inasmuch as semi-annual inside calls on househeating customers are already being made—the spring and fall visits for turnoffs and lightups of furnaces. The check readings can be taken at these times.

A second exception to PSC practice is the partial dismantling of the meter for the purpose of inserting the telemeter transmitter. Meters are supposed to be sealed, and only opened during the once-every-seventh-year servicing.

The test layout that Holyoke used to



How the telemeter operates

OPERATION of the telemeter is based on the principle of establishing a pneumatic link between the gas meter and the remote index device. Controlled flexing of the diaphragm at the driving end produces a corresponding movement at the receiving end. The driving diaphragm is actuated by a cam, which is driven from the gas meter proving circle shaft at a 50 to 1 gear reduction. The contour of the cam provides for a gradual forward movement of the diaphragm until the spring-loaded follower falls from the high point of the cam, resulting in a quick, reverse movement of the diaphragm. The recording mechanism of the remote indicating device is cocked by means of a biasing spring during the interval the driving diaphragm attains its maximum forward movement, and is tripped by the sudden collapse of pressure when the transmitter cam falls abruptly to low position. The index serves as the integrating unit, whereby its dial pointers indicate the number of impulse cycles originated by the gear-driven transmitter and hence the cubic feet recorded by the gas meter.

Factory and field tests show that the telemeter has a negligible effect on gas meter differential.

Repeated trials of the load imposed by the telemeter indicate that a maximum of 0.03 in. is added to gas meter differential. Specifications for smaller sizes of residential type gas meters usually permit a differential of 0.5 in. of water, and common practice assumes a value of approximately 0.25 in.

The effect on meter proof is in most cases imperceptible, due to the very slight increase in differential caused by the telemeter.

The index integrates the pneumatic impulses originated by the transmitter and records their total. The reading provided by the index duplicates the reading of the gas meter at some remote location.

The mechanism which performs the function of recording these impulses is essentially a diaphragm-operated ratchet, linked to an indexing train. The dials are reset by turning the springlift pointers to any position.

The diaphragm chamber is a formed metal plate which carries a right angle compression type connector. The diaphragm is secured to the chamber by a multiple screw-tightened ring which insures a complete seal.

A shaft, permanently attached to a plate fitted to the center of the diaphragm, provides the linkage necessary to drive the ratchet assembly. The ratchet drive is a long lever so formed as to advance the ratchet wheel one tooth for each impulse. The ratchet wheel has 10 teeth and is equipped with a spring detent pawl to prevent reverse movement of the ratchet wheel.

A takeoff gear on the ratchet wheel shaft transfers each advance of the ratchet wheel to the first index pointer. The index train is of the conventional type with a total of four pointers, each succeeding pointer being geared at 10:1 ratio.

establish the accuracy and durability of the telemeters was simple but effective, and obviously more than adequate to prove the devices. A Sangamo type B telemeter was installed in the division's shop, connected to a meter that was registering gas usage of a number of shop devices—burners, torches, muffle burners, unit heaters, etc. The receiver was mounted on the end of a test bench on which a grinding wheel was also mounted. When the wheel was in use, the receiver was subject to considerable vibration. When the temperature dropped to the frigid zone, the receiver was moved outside through the nearby window. When a hot spell would strike, it was moved inside again, to the hottest location that could be found in the shop.

The telemeter stood up under this grueling punishment for eight months. At the end of that time it was still registering well within the 2% tolerance permitted by the public service commission. Any divergence was on the low side, which is to be desired; and it was at all times negligible. The device was on intermittent operation, with loads varying from pilot only to about 200 ft per hour. Checked out against the meter itself, the Sangamo was low by only a few feet on an average month's gas usage. Mr. Ballou concludes that the telemeter won't go far out of adjustment; it's either very, very close to 100% accuracy or it's completely stopped.

Holyoke is the real pioneer in the use of domestic telemetering. Many other companies have already tested the device, and most reports have been very favorable, but the Massachusetts city is the first to put in an order of such magnitude. To date, most of the other companies feel the device is too expensive for widespread application. Fred W. Dopke, vice president of the Indiana Gas & Water Co. Inc., Indianapolis, sums up the thinking of many gas company executives in this way:

"It might be possible to justify (the cost of) this unit considering the intangibles involved. Because it will not be necessary for a meterman to enter the customer's home, better customer relations should result. It would no longer be necessary to have a duplicate house key in order to permit the meter reader to enter the home during the customer's absence.

"I know of no case where a key that was turned over to us for meter reading purposes got us into difficulty because it was used for other purposes. . . .

"We are convinced something must be done in order to permit meters to be read from the outside. Several ideas have been advanced to permit this. Our engineering department informs us that some of the gas meter companies have meters under field study that are designed to compensate for gas temperature changes. If this problem is solved, outdoor meter setting will become practical in this area, where we experience wide temperature variations."

Indiana Gas reported it had seven telemetering units in operation, with all working satisfactorily. Cost studies that have been made by the management show that the actual cost of all material used to make the installation totals $10.64, not including handling charges. According to Mr. Dopke, "it takes about 1½ hours to install the transmitter unit in the shop and another 1½ hours in the field. Based on our 1955 labor rates, the labor cost is $5.90. Our people estimate that the charge for the truck in connection with the field installation at

our rates will add another 78 cents to the cost of the installation."

"Any sort" of cost figures developed, however, depending upon how much is added for overhead and supervision, says Mr. Dopke.

As for the cost of meter reading at Indiana Gas, it averages 7.9 cents per meter read. This, of course, would not be a proper figure to use for purposes of comparison, because in most companies the telemeters would not be used on "average" installations.

In Philadelphia, E. N. Keller of Philadelphia Electric Co. echoed the sentiment that the cost is too high at present. "In new homes we much prefer the installation of the glass block with the meter reversed inside to enable the meter reader to get a reading from the outside and thus keep down the cost of reading meters, because under such conditions there will be no misses."

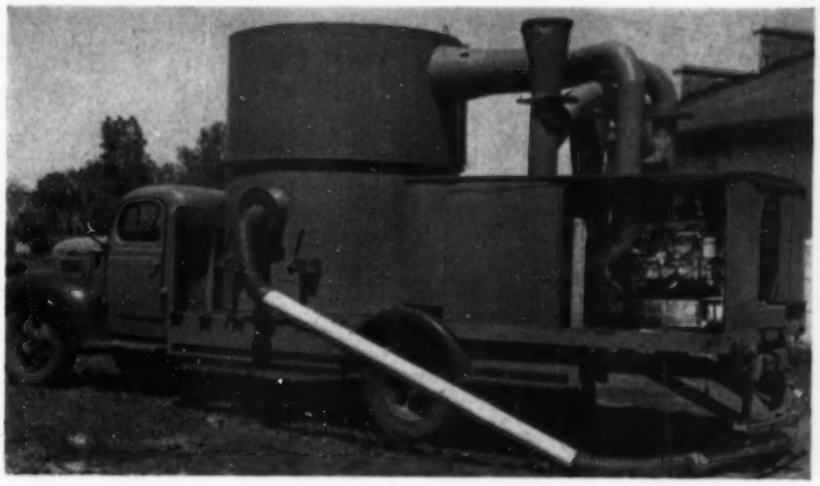
Several companies contacted for information reported the devices were not suitable for reasons that did not reflect on either their cost or their accuracy or any other inherent characteristic. The necessity of getting a change in PSC regulations discouraged one company. Several companies do not have tin meters, or are abandoning them—and Sangamo telemeters are not manufactured for any but tincase models.

James Gary of Seattle Gas reports the telemeters his company has tested gave very accurate results, but "we are installing very few tin meters except on a replacement basis. All of our purchases are hard-case meters and the trend here is to more and more outside meter locations. Our future meter purchases will probably be almost exclusively hard-case meters. With the introduction of natural gas, we will probably go to outside locations in most cases, also."

Consumers Power Co. of Jackson, Mich., is also discarding tincase meters. No meters of this description have been purchased since 1946.

New Bedford (Mass.) Gas & Edison Light Co. has a limited number of telemeters on its lines. While the cost is felt to be too high for full-scale use, "there are many locations at customers' premises where this type of meter would pay for itself in convenience alone," according to Gas Superintendent C. L. McLauchlin.

"We believe this installation should be explored further from an experience standpoint, for it has a potential advantage over the standard meter sets within buildings." ■



The centrifugal blower draws all the dust and scale loosened in the main into the dust collector and filters the air. It is capable of cleaning a section of various sizes from 2-in. to 12-in. mains up to 700 ft in length.

Dust removal operation boosts outlet pressure

MORE than three wheelbarrow loads of dust and scale were recently removed by the Terre Haute (Ind.) Gas Co. in the cleaning of a 438-ft, 3-in. main that had been in service for more than 100 years. Result of the cleaning operation was an increase in outlet pressure from 4 to 7 in. water column.

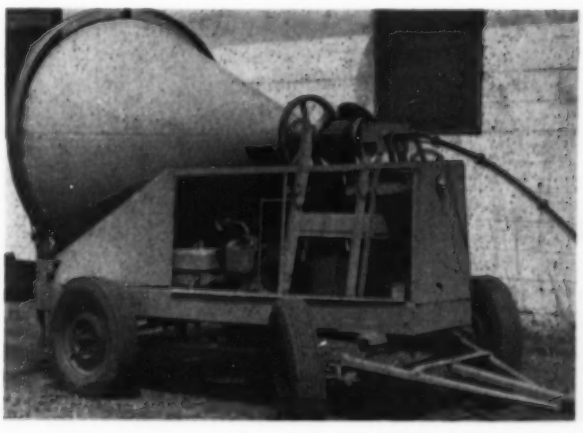
The accumulation of dust and scale formed in the line with the introduction of dry gas when the system was converted from manufactured to natural gas.

The cleaning operation was handled by the Hoosier Pipe Cleaning Co., Terre Haute, making use of a specially designed blower and rodding machine. The blower was used to draw loose scale and dirt out of the line as it was loosened by the rodding machine. The exhaust manifold of the blower was equipped with a filter system to prevent dust from being blown into the air.

The rodding machine was used to feed a rod equipped with a brass pilot head into the main at a rate of 15 ft per minute. Once through the full length of the 438-ft main the pilot was removed and a flexible steel cutter blade was attached, and the rod pulled back through the line. A draft was created by the blower during both trips of the rod to draw off the removed material.

The rodding machine had a total capacity of 1000 ft of rod. It was equipped with a gasoline engine that drove the cutting blade at 300 revolutions per minute. The length of rod is contained in a cone-shaped drum.

The blower was also used to purge the line of gas before the operation was started. Some loose material was also drawn out at the same time.



The rodding machine unwinds the cable as the cone-shaped drum revolves and the flexible cutter blades twist at approximately 300 rpm through the main. The particles and the dust loosened by the blades are drawn through a tube into the blower.

The angle between the tangent, which controls the diaphragm stroke, and the valve crank, which controls the valve stroke, determines the timing of the valve and the diaphragm to produce . . .

THE PAY-OFF STROKE

By EDWARD R. GILMORE
Chief Engineer
Lancaster Meter Parts Co.
Lancaster, Ohio

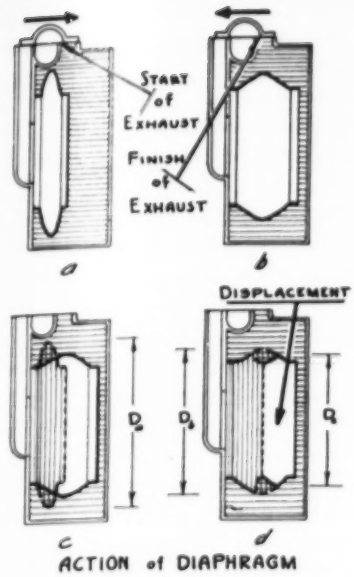
THE DIAPHRAGM DISPLACES THE GAS DELIVERED BY THE METER.

THE amount of gas delivered by most displacement meters now in use is determined by the diaphragms and their strokes.

Diaphragm displacement

The volume of gas displaced by a diaphragm is the difference between the volume of gas in the measuring chamber the instant gas starts to exhaust and that which is left in the chamber at the instant at which the exhaust ceases.

This article has been written especially for GAS, based on a talk presented at the AGA distribution meeting in April. All illustrations are by the author.



ACTION of DIAPHRAGM

The positions of the entire diaphragm structure when the valve releases the gas to exhaust and when the valve closes the exhaust opening are the only positions of the diaphragm that control the total volume of gas displaced. These positions for a specific diaphragm are dependent on:

the design and material of the diaphragm,

the diaphragm linkage mechanism,

the differential across the diaphragm.

Diaphragm design*

Drawing "a" represents a bellows-type diaphragm at the instant the valve opens the case compartment to exhaust. (In most meters the valve opens the inside compartment port for intake at the same instant.)

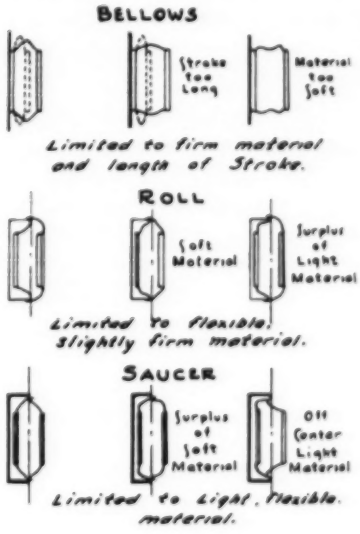
Drawing "b" represents the position of the same diaphragm at the time the valve closes the exhaust from the case compartment.

The clear area within the boundaries of the diaphragm and the center partition, in both drawings, represents the volume inside the diaphragm. The cross-lined area, outside the diaphragm and inside the case, represents the volume in the case compartment.

Drawing "c" shows the diaphragm position of drawing "a", superimposed, as the vertically lined section on the diaphragm position shown in drawing "b". The double cross-lined areas must be subtracted from the clear area, inside the diaphragm, as this gas has not actually been exhausted from the meter.

The clear area in drawing "d" represents the actual displacement of the diaphragm. The double cross-lined areas have been substracted. This volume is the difference between the volume in the case compartment at the start of exhaust and the amount remaining at the finish.

It is readily seen from this study that this type of diaphragm functions most efficiently near the closed position. The effective diameter decreases rapidly as the diaphragm moves out. In order to obtain more stroke from this type of diaphragm it is necessary to use two bellows.



DIAPHRAGMS

There are many factors that must be considered in diaphragm design not mentioned here. The effect of some of the major factors on the measuring positions of the diaphragm furnishes adequate material for this study.

The drawings shown here will assist in identifying the types of diaphragms referred to. An attempt has been made in these drawings to show the diaphragms at their extreme "in" and "out" positions.

The single-bellows design is limited to a comparatively short stroke and rather heavy, firm material. A long stroke not only reduces the effective displacement but also causes the bellows to collapse. This is especially true if light, flexible material is used.

The most satisfactory displacement is obtained by using a stroke as close to the closed position as possible.

A double bellows must be used for a satisfactory long stroke.

The roll design has a long effective stroke. The material used to produce the desired results must be flexible yet firm enough not to have the roll reversed by any differential that may be imposed across the diaphragm in operation.

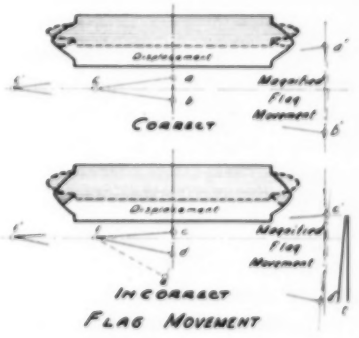
The most satisfactory displacement is obtained by using a stroke with equidistant travel each way from the hinging plane of the material.

The saucer design has a long effective stroke. The best results are produced by using light, flexible material, with a limited amount of surplus.

The most satisfactory displacement is obtained by using a stroke with equidistant travel from the central plane at which the material hinges.

Diaphragm linkage mechanism

The portion of the available diaphragm stroke that is used to measure the displacement is controlled by the diaphragm linkage mechanism. This linkage and its functioning must be given great consideration as it is the key to obtaining the most efficient "pay-off stroke."



Movement of flag

The flag should be of such length, and the flag rod so positioned, that the rocker shaft moves the same distance "in" from its center arc position as it does "out," where it crosses the center line of the diaphragm travel. This is shown in the upper drawing noted as *correct*. The arc is from a to b or a' to b' of the magnified drawing.

The *incorrect* movement in the lower drawing shows that with the same amount of arc motion, not equally divided, there is less forward movement. A longer tangent will be required to give a greater arc, to obtain the same forward movement shown in the upper drawing.

The diaphragm design, as well as the arc of the flag, in the construction illustrated is less effective when used to an extreme "out" position.

The equal division of the arc swing of the flag, with diaphragm designs

*The tin case meter and its parts are used here for most of the illustrations and examples, merely to improve continuity. The basic principles discussed in the text apply to all diaphragm meters.

The pay-off stroke... Decide on the stroke that gives the best all around performance

with longer strokes, is even more important. The greater the arc required for the stroke the less efficient the mechanism becomes and the more imperative it is that the best part of the arc be used. The dotted line f_1 - e on thelower drawing shows the effect increased off-center division has on a diaphragm requiring twice the stroke a - b. The flag, in this case, has been shown of slightly increased length to meet the conditions specified for the upper drawing. The arc required is c - d - e, assuming these points to be on the larger arc.

The angle between the flag and long flag arm

The angle between the long flag arm and flag determines the portion of the arc movement of the flag that is used to place the diaphragms in pay-off position.

Taking into consideration the best pay-off position of the diaphragm, and the best portion of the flag arc, a general rule for obtaining the most efficient overall diaphragm displacement stroke could be set up, if used with the proper discretion.

This rule would be to attach the long flag arm securely to the flag rod at such an angle to the flag that the diaphragm is within approximately 5% of the end of the free, unrestricted *in* stroke when it is at the end of the *in* stroke required for an okay proof. In cases where there is insufficient material in the diaphragm to do this, and still leave as much or more clearance on the *out* stroke, the percentage should be reduced.

This angle is extremely important and enough attention has not been paid to it over the years. The only way to be sure that as near the correct angle, for any type and size of meter, as possible is being used, is to run the following tests:

Tests to establish pay-off strokes

1. Run proof and differential tests on several meters of each make and size, which are known to be correctly assembled.
2. Repeat the tests after relocating the long flag arms to use the most of the diaphragm *in* stroke.
3. Relocate the long flag arms to use most of the *out* stroke of the diaphragm and repeat the tests.

Be sure to leave sufficient clearance at the end of all strokes, so that the diaphragm has no tendency to short stroke. Be sure also that no other change is made other than to relocate the long flag arms.

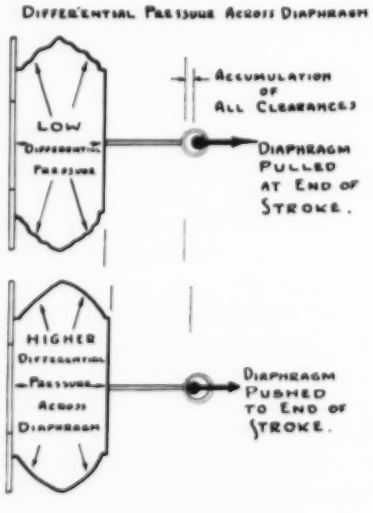
4. Carefully analyze the data obtained from the tests for indications of the most all around stroke efficiency.
5. Decide on the pay-off stroke that gives the best all around performance for each type and size of meter.
6. See that the gas being delivered by the meters going into service is displaced by the pay-off stroke decided on.

Advantages

Some of the advantages of using the equal travel from the center plane parallel to the diaphragm for the flag arc and the most efficient part of the diaphragm stroke are:

1. A shorter diaphragm stroke is required.
2. Less material is required in the diaphragm.
3. A shorter tangent length is used.
4. The arc motion of the flag is reduced.
5. The overall displacement is more uniform.
6. The meter operates at a lower and more uniform differential.

Effect of differential across the diaphragm


DIFFERENTIAL PRESSURE ACROSS DIAPHRAGM
LOW
DIFFERENTIAL PRESSURE
ACCUMULATION OF ALL CLEARANCES
DIAPHRAGM PULLED AT END OF STROKE.
HIGHER DIFFERENTIAL PRESSURE ACROSS DIAPHRAGM
DIAPHRAGM PUSHED TO END OF STROKE.

The higher the differential across a specific diaphragm at its measuring position, the greater the displacement will be. The effect of higher differential is more pronounced on a diaphragm with a surplus of material, especially if the material is soft and flexible.

The effect of increased differential is indicated in the drawings. The upper drawing portrays the diaphragm with a small differential imposed across it. The flexible material is not fully smoothed out. The pan is being *pulled to the end of the stroke* by the other diaphragm. It could move further out, by the amount of accumulated tolerances in the linkages, if there were sufficient differential to move it.

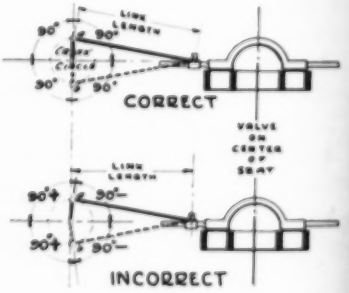
Additional differential

Additional differential, as depicted in the lower drawing, is sufficient to *push the pan to the end of the stroke*. The clearances have been taken up, and the pan has made a longer stroke, producing more displacement. The diaphragm flexible material has smoothed out and filled more fully, giving more displacement also.

Valve control

START AND FINISH POSITIONS OF DIAPHRAGM STROKE DETERMINE DELIVERY.

The starting and stopping points of the diaphragm stroke depend on the valve. The valve must be at the same control position on its seat, but going in the opposite direction when the diaphragm reaches one end position and then the other. This control point is very close to the center of the valve seat.



VALVE SETTING

For each revolution of the meter mechanism, the valve crank revolves once; one diaphragm makes two complete

strokes, one "in" and one "out." The start and finish of the strokes of one diaphragm occur at 180-degree intervals. The valve must therefore arrive at the control point on the seat at 180-degree intervals.

In order to obtain the desired condition, it is necessary to control the valve stroke in such a manner as to position the valve on the center of its seat when the valve crank is at 90-degrees to the line of travel of the valve.

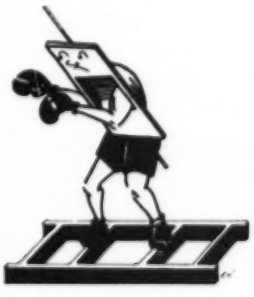
The upper drawing, labeled *correct,* shows that if the length of the valve link is correct, it is possible to have the valve arrive at the center of the seat at 180-degree intervals. The valve link length must equal

$$\sqrt{(\text{length of crank})^2 + (\text{distance from crank center to valve wrist})^2}$$

to accomplish this.

The points of all valve functions occur within a few degrees of seat center position. If the valves are advanced or retarded slightly by changing the tangent and crank angle in proving the meter, the 180-degree valve positioning will still be maintained.

The *incorrect* setting, as shown in the lower drawing, is based on a link length, which gives even travel from the center of the seat. With this length link it is impossible to have the valve arrive at the center of its seat at 180-degree intervals.

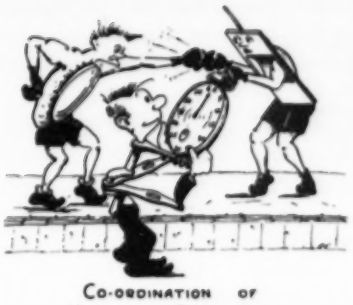


CENTER POSITION OF VALVE STROKE IS DECISIVE.

It is the positioning of the valve on the center of its seat at 180-degree intervals that is important in the valve stroke.

Coordination of the valve and diaphragm

The angle between the tangent, which controls the diaphragm stroke, and the valve crank, which controls the valve stroke, determines the timing of the valve and the diaphragm, to produce the pay-off stroke.

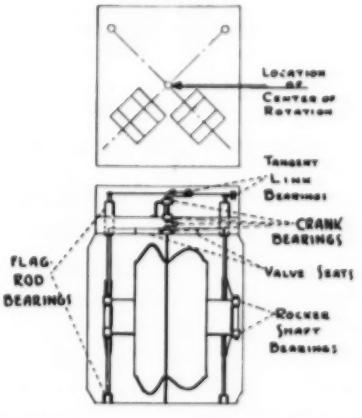


CO-ORDINATION OF VALVE AND DIAPHRAGM STROKES.

The pay-off stroke of each diaphragm has to be coordinated with the other, so that the meter operates smoothly and at its maximum efficiency, as a measuring device and as an engine. The prover checks the efficiency of measurement and the draft gauge the efficiency of the engine.

The coordination of the units is accomplished by properly mounting the fixed and moving parts about the central axis of rotation.

The center of rotation



CENTER OF ROTATION

Every meter has a central axis about which the parts of the mechanism move or are mounted. This axis is usually referred to as the crank. This axis must be correctly located in respect to the fixed parts of the meter assembly. The crank shaft is usually located by two or more bearings; one or more of these are movable. In positioning these bearings, care must be exercised not only to get them in line, but also to have them in the right position in respect to the flag rod glands and the valve seats.

The upper drawing shows the relationship of the seats and flag rods to the center of rotation. The lower drawing points out other parts and bearings that must be aligned with respect to the central axis.

Trying to watch the operation of a meter, all at once, is like trying to see everything that goes on at a four-ring circus. However, in a meter, the same main performance is repeated in every ring at 90-degree position to the tangent crank, as it rotates on the central axis.

As the central axis rotates, a worm mounted thereon actuates the index. The index merely registers the number of revolutions of the meter mechanism.

Index drive

The index, and its drive, which usually consists of a gear, shafts, dogs and a stuffing box on open top meters, has nothing to do with the actual measurement of the gas passing through the meter. However, the condition and alignment of these parts do have a decided effect on the operation of the meter and measurement. The effect is the increase or decrease in the differential across the diaphragm caused by the work required to drive the index.

Effect of various parts on the pay-off stroke

THE TANGENT AND VALVE CRANK ANGLE DETERMINE THE TIMING.

Tangent Adjustments: Both the tangent length and its angular relationship to the valve crank, on most meters, are adjustable so that limited adjustments can be made in the final calibration of the pay-off stroke.

The tangent length controls the diaphragm stroke only to the extent that the angular position of the valve crank permits.

The major angle between the tangent and valve crank is determined by the design of the meter. Most meters require that the crank be advanced a few degrees ahead of this major angle to obtain the correct relationship between the proofs at the capacity and check rates. The valve advance thus affected tends to position the diaphragm stroke end positions more nearly alike at both the

capacity and check rates of flow. If the valves are not advanced, the higher differential across the diaphragm at the higher speeds results in more displacement. A specific meter would deliver the same volume of gas at any rate of flow, within its capacity range, if the differential across the diaphragm could be maintained the same at the time of exhaust valve opening and closing.

For a very general rule, the advance of the crank 1° cause 1% less displacement on the open rate of flow but decreases the check rate displacement only about a quarter as much.

Each make and size of meter has a predetermined tangent length and crank angle of advance, required for the average meter. Items affecting the amount of variance from this length and angle are:

1. Flexibility of diaphragm material.
2. Amount of surplus diaphragm material.
3. Diaphragm and flag stroke deviations.
4. Valve and valve stroke deviations.
5. Clearance at bearing points.
6. Friction.

Tangent posts tipped, either accidentally or on purpose, are detrimental to sustaining the desired displacement of the meter in service.

Bent cranks are confusing when one is trying to coordinate the valves and diaphragms. Such cranks should be straightened or replaced.

ECCENTRIC WORM TROUBLE IS NOT READILY DETECTED.

Slightly eccentric worms may not be noticed in repair or in minor draft gauge fluctuations. They may result in excessive wear in service. Be sure to check this possibility, along with clearance and bent cranks, if wear at this point is giving trouble.

Index shaft alignment is important, even though most drive dogs are designed to allow for a moderate amount of misalignment. Make sure that the dogs are in good condition and mounted correctly and securely on the drive shaft. Align the shafts by sighting from at least two right-angle positions.

The degree of tightness to which stuffing boxes should be packed is somewhat critical. They must be tight enough not to leak, yet free enough to permit unrestricted movement of the shafts. The friction on the shaft must be kept at a minimum, and uniform throughout the period of service of the meter. The lubricated spring-type packing has proved very successful, especially in index shaft stuffing boxes.

A bent flag rod not only causes binds, but also lets the diaphragm make a wild swing instead of the desired measured stroke.

THE TRUE CONDITION CANNOT BE KNOWN WITHOUT REMOVAL OF THE CASEMENT.

The only way to tell the condition of a diaphragm is by actually feeling it. The leather may look dry on the outside but will still have sufficient oil in the pocket of long fibers. Squeeze a fold of the leather lightly—if oil comes to the surface, there is plenty of oil in the diaphragm.

Excess oiling has proved a great factor in the speed-up of meter proofs in service. Do not oil a diaphragm just because doing so will bring the meter back in proof, or lower the differential. The excess oil will not remain in the diaphragm very long, and the proof will speed up again.

There should be enough oil in the leather to seal the leather at differentials in pressure that may be experienced in the normal operation of the meter.

In testing diaphragms for leaks, a differential of over 2 in. of water across the diaphragm should never be used. If greater pressures are used to test for the possibility of the diaphragm coming loose from the pan, the leaks that occur at the higher pressure should be disregarded.

WEAR AT THESE POINTS AFFECTS PAYOFF STROKE
WEAR AT THESE POINTS AFFECTS VALVE TIMING
WEAR AT ANY POINT AFFECTS VALVE & DIAPHRAGM COORDINATION

WEAR

Excessive wear at bearing points is detrimental in maintaining a consistent pay-off stroke in service. Some of the points where wear is likely to occur and the functions of the meter that are affected by the wear are shown above.

Friction and the change in degree of friction in service, is one of the most serious problems that exists in displacement meter measurement. The effect on the pay-off stroke is due to the change in differential across the diaphragm at the end of the stroke.

Everything possible should be done to keep friction at a uniform minimum:

1. Align all bearings for a dry free running fit.
2. Pack all stuffing boxes lightly.
3. Remove all burrs and loose particles from the edges of the ground surfaces.
4. All rotating, oscillating or sliding surfaces should be thoroughly cleaned.
5. Only a very limited amount of the best lubricant obtainable should be used at any point.

It is the change in friction that causes the meter to change proof in service.

* * * *

All parts of the meter assist in obtaining or can influence the pay-off stroke.

The factor that is paramount, over all the rest, is the angle at which the long flag arm is attached to the flag rod, in respect to the flag. This angle determines whether the diaphragm makes a wild swing, or a controllable stroke.

I have drawn up no conclusions for this discussion as it can never be concluded without the answers to a few questions:

Do you know what part of the diaphragm stroke is used in your meters?

Are you sure that your meters are using the best pay-off stroke?

If the answer to one or both of these questions is No — Do you believe that it would pay you to investigate.

Part 7 in a Series

The New Gas Transmission and Distribution Piping Code

ASA—B31—SECTION 8

A background discussion by **FRED A. HOUGH**

Construction and testing methods

Chapter 4 stresses good specifications, close inspection

THE May and June installments in this series on the new code covered design practice as set forth in Chapter 4. Before dispensing with that chapter, let us consider the provisions regarding the construction and testing of pipelines and mains (Sections 841.2, 841.3, and 841.4).

The first requirement of the code pertaining to construction is that written specifications shall be provided for all construction of pipelines and mains. While one provision of such specifications could be that the work shall be done in accordance with Section 8 of the Pressure Piping Code, the code itself is not intended to serve as a set of specifications. In many cases, the code prescribes acceptable alternate practices. Specifications should designate the particular practice the owner wishes to use. The code does not include many things that should be spelled out in specifications that are to be part of an agreement between the owner and the contractor. Usually, it is also desirable that such items be spelled out in specifications that are to be used by the owner's own crews. The code does not imply, of course, that a separate set of specifications be written for each job. Often, standard specifications with additions or insertions to fit specific job requirements can be used.

Owners who wish to keep their records so that they provide good evidence that work has been done in accordance with the code can either file in the job file a copy of the specifications under which the job was built or can make reference there to the standard specifications that were used.

The code recommends that the construction specifications used shall cover all phases of the work and shall be in sufficient detail to cover the requirements of the code. The development of a good set of specifications, with follow-up and inspection to assure those in responsible charge of the work that the specifications are being complied with, is, of course, widely recognized as a necessary management procedure to assure sound construction and safety, regardless of whether the work is done by outside contractors or company crews.

A study of the records of past pipeline failures leads to the conclusion that many failures are the result of inadequate inspection during construction.

Our past discussions of pipe specifications and the inspection of pipe at the pipe mill emphasized the great importance of eliminating notches and scratches. It can probably be safely said that most failures of pipelines that have involved the actual bursting of the pipe at pressures below that required to stress the pipe to its specified minimum tensile strength start in a notch or groove or crack. These may be defects in longitudinal or round seam welds or they may be defects in the plate. Such defects produce triaxial stresses in the plate in the immediate vicinity of the notch and cause the plate to fail in a brittle manner. Such defects are especially serious at low temperatures and in the less ductile or notch-sensitive steels.

Cold working tends to produce notch sensitivity; consequently, if the groove or notch is caused by a blunt instrument, which also dents or deforms the steel and thus in effect cold works the steel in the immediate vicinity of the notch, an especially dangerous defect is the result. If a bulldozer blade or tractor track notches a pipe it usually also cold works the plate in the vicinity of the notch and, if so, pipeline failures of the brittle type sometimes result.

It is evident from this discussion, I think, that one of the major objectives of an inspection organization on a pipeline job is to see to it that the pipeline gets into the ground and is safely covered up without having any scratches or notches inflicted during the construction period, and that no pipe goes into the pipeline carrying such defects as a result of mishandling either in the pipe mill or during transportation. Even after a pipeline is covered by backfill it is sometimes damaged by construction equipment sinking through wet backfill and gouging the pipe.

Procedures are prescribed in the code for eliminating notches and grooves when they are found in pipe in the field. Such defects can be removed by grinding, providing the resulting wall thickness is not less than the minimum prescribed by the code for the conditions of usage. When deeper grinding would be required the damaged portion of pipe must be cut out of the line and a new cylindrical section installed in its place. Any welding or patching of gouges and grooves is prohibited.

Dents that are more than ¼-in. deep must be removed by cutting out a section of pipe and replacing it with a new cylindrical section.

Sections of pipe containing arc burns must be cut out and replaced with a new cylindrical section, unless the metallurgical notch caused by the arc burn can be completely removed by grinding without reducing the pipe wall thickness below the minimum specified.

The amount of inspection required on a pipeline job, and the number of inspectors necessary to do an adequate inspection job, are questions that are not answered by the code because, of course, general answers are not possible. The former depends upon the know-how and reliability of the organization doing the construction work and upon the integrity of the individuals involved. The number of inspectors on a big inch pipeline spread usually varies from two to ten. The smaller figure is probably never adequate and even the larger figure may be inadequate at times.

In addition to detecting notches and scratches and similar defects, the field

inspection organization is concerned with other factors that affect the safety of the pipeline, such as welding inspection, coating inspection, and the inspection of bending operations. Lowering-in and backfilling also require adequate inspection. The code does not attempt to spell out in detail just what inspection operations are necessary but does give some suggestions that the committee thought would be helpful as indicators of the intensity and quality of the inspection that the committee has in mind.

The code devotes considerable attention to pipe bends. Here, again, excessive cold working of the pipe is undesirable. Long-radius cold bends made in the field under properly controlled conditions are considered to be satisfactory from this standpoint. However, bends that deform the pipe from its cylindrical shape or cause excessive localized cold working by buckling or wrinkling are not acceptable. Cold wrinkle bends are in the words of the code, "permitted but not preferred on systems operating at 40% or more of the specified minimum yield strength of the pipe." Cold wrinkle bends, of course, cause a great deal more cold working of the metal at the wrinkle than occurs at any point in a long-radius smooth bend. The code cautions against wrinkle bends that have sharp curved surfaces or wrinkles that are placed on the pipe across the longitudinal seam. Such wrinkles are prolific sources of trouble.

Mitered bends are not approved for pipelines operating at 40% or more of the specified minimum yield strength of the pipe. However, mitered deflections up to 3 degrees, even in such high pressure pipe, are permitted.

Larger mitered angles are permitted for pipelines operating at lower pressures. A 90° miter is permissible in systems operating at 10% of the specified minimum yield strength or less. The chief objection to small angle miters made in the field is the difficulty of getting a good match-up that will permit making a weld comparable in quality to the other welds in the pipeline.

The code discusses in some detail precautions necessary to avoid explosions of gas-air mixtures or uncontrolled fires during construction operations. In general, elaborate purging procedures, such as those described in the American Gas Association Purging Manual, are not required. It does point out certain specific cases, however, where such purging procedures are necessary.

The testing of gas transmission and distribution piping, after construction is completed but before the pipe is placed in operation, was probably given more attention by the committee than any other subject. The test requirements finally adopted by the committee represented a considerable departure from the testing provisions of old Section 8. That section stated that gas transmission lines must be capable of withstanding a test pressure 50 psi higher than the maximum pressure at which the line is to be operated. This was interpreted by many companies as not requiring a field test. Consequently, it was quite general practice in the gas industry to place high pressure pipelines in operation without prior testing to prove strength.

The committee early adopted the policy that all facilities must be tested before they are placed in operation. From the standpoint of testing requirements, the code divides piping into three categories: The highest pressure category, piping that operates above 30% of the specified minimum yield strength of the pipe; the intermediate pressure category, pipe that operates at less than 30% of the specified minimum yield strength of the pipe, but at more than 100 psi; and the lowest pressure category, piping that operates at less than 100 psi.

The code requires that piping falling in all three categories must be tested for leakage before placing in operation. All piping in the intermediate pressure category, except piping in location Class 1, must be tested to prove strength.

The use of gas as a test medium for high pressure pipelines is greatly restricted in the new code, insofar as tests to prove strength are concerned. Gas can be used for this purpose only in pipelines located in location Class 1, which is the least populated of the four location classes into which all gas piping locations are divided in the code. The use of gas in location Class 1 is further restricted by paragraph 841.5 of the code, which states, "All testing of pipelines and mains after construction shall be done with due regard for the safety of employees and the public during the test. When air or gas is used, suitable steps shall be taken to keep persons not working on the testing operations out of the testing areas during the period in which the hoop stress is first raised from 50% of the specified minimum yield strength to the maximum test stress, and until the pressure is reduced to the maximum operating pressure."

Since a pipeline designed to operate at the maximum pressure permissible by the code in location Class 1 would normally be tested to 79.2% of the minimum yield strength if gas is used, this paragraph of the code requires that if the testing is done with gas, the public shall be removed from the test area to a safe location for a period of perhaps several hours. If the public cannot be kept at a safe distance from the pipeline during the test, water must be used as the test medium. Pipelines in location Class 2 (fringe areas around cities and towns and the more densely populated rural areas) can be tested under the code with air or water. High pressure pipelines in towns and cities must be tested with water.

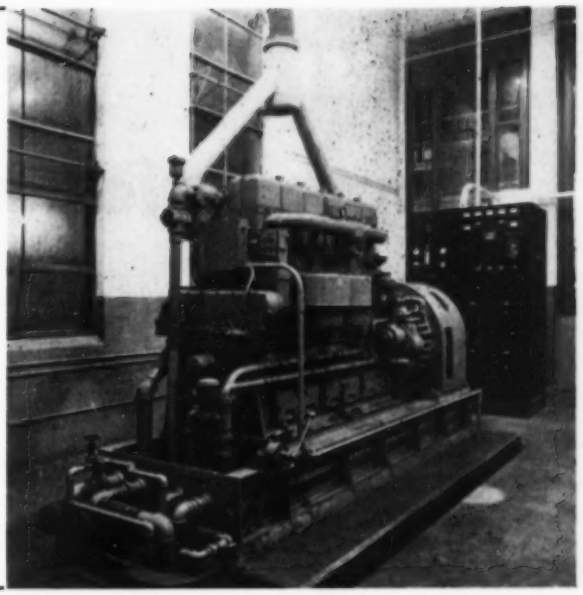
The code requires a minimum test pressure that shall be used to prove the strength of pipelines and mains in all four location classes. It also prescribes the maximum test pressure that may be used if air or gas is used as the test medium. The committee felt that the setting for maximum test pressure is necessary to avoid excessive hazards of life and property during the test. No maximum test pressure is prescribed if water is used as the test medium.

The practice of companies using water for testing varies a great deal. Some use as the test pressure the minimum prescribed by the code; others use pressures high enough to cause some actual yielding of the weakest pipe in the section under test.

The strength test provisions of the new code are quite lengthy and include special requirements to meet special conditions that are sometimes encountered during the testing of pipelines and mains. For example, requirements for hydrostatic testing are modified in situations where water of unsatisfactory quality is not available in sufficient quantities or in cases where testing must be done during period when the ground temperature is below 32° F, or in situations where there is danger that the ground temperature might drop to 32° or less during the test. The code also requires that, "The operating company shall maintain in its file for the useful life of each pipeline and main records showing the type of fluid used for test and the test pressure."

In addition to the tests required to prove strength, all transmission lines and mains must be leak-tested before they are placed in operation.

Gas-driven generator makes standby power for Sabre Jet plant



This is the 6G-510 engine with a 200-kw Elliott generator in the main power supply house of North American Aviation. It is the heart of special standby electric system that protects the plant.

AT North American Aviation's Sabre Jet plant in Columbus, Ohio, a total of 400 kw of standby power is provided to sustain vital operations in the event of primary power failure. Four generators supply the essential emergency requirements of the plant; the primary unit is a 200-kw Elliott generator driven by a spark ignited Superior gas engine rated 295 bhp at 900 rpm with a maximum of 325 bhp at 1000 rpm. This engine is a product of the National Supply Co., engine division.

Additional standby power is provided by a 170-kw Buffalo gasoline-driven generator, a 25-kw gas-driven emergency generator made by U. S. Motors Co., and a 15-kw gas-driven emergency generator made by Kohler Electric.

Standby starter

The main standby unit is started by compressed air from steam-driven plant air compressors. If the plant air pressure is off, and primary electric power on, the unit is started with an electric-powered compressor. If plant air pressure and electric power both are off, a gasoline-driven air compressor is used to start the unit.

A gas regulator and solenoid valve automatically control fuel flow to the standby unit as starting and running require.

All generators start automatically on power failure. The main standby generator starts eight seconds after a power failure through an auxiliary contact actuated by the power lapse, which in turn energizes the engine starter.

The cycle proceeds in this manner: When primary source power fails, the opening of the power supply relay energizes a dc-operated solenoid air valve, which allows air to flow into the air-starting motor to turn the engine. A bell alarm and a pilot indication are activated automatically when the primary supply voltage drops below normal value. However, the actual start is delayed by the eight-second time delay device. This delay prevents "short-run" starts if primary power falters only momentarily.

Proper value

When the standby generated voltage reaches its proper value, the primary power breaker opens and the emergency power breaker closes. (Loads may be picked up automatically or manually.)

The preceding sequence of operation will take place in reverse order when primary power service is restored.

To provide for regular checks on the equipment a test control switch is operated to simulate a failure of primary source power. When this test control switch is closed (on), the starting cycle begins; when the switch is opened (off), the cycle of operations is reversed.

Power house

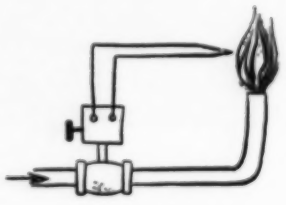
The standby equipment is located in the power house. All starting and stopping cycles are actuated there from the main switchboard controlling power house equipment. Thus if a power failure should be localized in the power house transformer vault, the emergency equipment takes over even if the primary power source (commercial) has not been interrupted.

The heavy-duty engine is further protected against defective oil pressure, excessive water temperature, and speed by means of alarm and shutdown controls on the auxiliary panel. As the engine starts automatically and lubrication oil pressure increases, automatic energizing of the controls is indicated by pilot light. Automatic stopping is accomplished by automatic reversing of this sequence. Storage batteries energize the alarm panel when the standby engine stops and no other power is available.

All pilot lights and alarms can be tested at any time, with engine running or idle. ■

Combustion safeguard systems

By **CONRAD CLAESON** • Barber-Colman Co., Rockford, Ill.



With the increased use of gas and more efficient gas burners and combustion chambers has come the need for combustion safeguards and protective devices. Many mechanical and electronic devices are available for both the domestic and industrial fields.

COMBUSTION safeguards pertaining to the combustion of commonly used fuels such as gas have a wide variety of application. A combustion safeguard that provides sufficient protection on a relatively small sized burner and combustion chamber may not necessarily be adequate for a larger installation.

With the increased use of gas more efficient gas burners and combustion chambers have been designed and the need for combustion safeguards and protective devices is quite evident.

One of the first devices used and still used as a means of shutting off fuel in event of a fuel failure is a pressure switch *(Fig. 1)*. This switch is mounted on the fuel supply line and connected to a valve. In the event the pressure should drop below a predetermined setting, the valve closes to cut off the fuel.

The valve should be a manually reset type, which requires a manual operation to reopen it, rather than an automatic valve. If an automatic valve were used, it would reopen when pressure was reestablished, in which case fuel would be permitted to enter the combustion chamber without a suitable means of ignition present.

In addition to pressure switches used in the air or fuel lines, other devices have been added to guard against the possibility of explosions due to other types of failure. Included in the list are limiting controls, low water cutouts, draft controls, and damper controls. Manual reset valves, along with these other devices, are included in the items that are submitted for approval by insurance laboratories.

One of the devices used to provide protection against flame failure is a bi-metal strip *(Fig. 2)*. The flame is directed against this bi-metal device, which warps to close a set of contacts and in turn keep a valve open. In event of a flame failure, the bi-metal strip cools and opens the contacts, which causes the valve to close.

One of the objections to such a device is that it may take a permanent set if subjected to too high a temperature. If properly applied, it is satisfactory as a combustion safeguard when used with relatively small sized atmospheric burners.

Another means used to sense the presence of a flame is a thermocouple *(Fig. 3)*. A thermocouple is formed when two unlike materials are joined. An electromotive force is generated when one junction of a thermocouple is at a different temperature than the other junction. Because the amount of emf developed is small, it requires a manual resetting device or valve for operation.

In such a system a pilot flame would have to be established and the operator would manually have to actuate the reset to open the valve. After the flame had heated the thermocouple, sufficient amount of emf would be developed, which in turn would keep the valve open. There is not sufficient emf developed to open the valve, but there is sufficient emf to keep the valve open after the hot junction of the thermocouple is heated. This generally is a very satisfactory type of combustion safeguard. It is used on systems where only one solenoid valve is used which functions as a control valve as well as a safety valve.

A thermocouple device is widely used as a means of detecting the presence of a flame in the smaller burner or domestic field. It is very commonly used on gas hot water heaters, domestic gas burners, space heaters, and similar type applications where the amount of fuel burned is not too great and where the combustion chamber has a reasonable movement of air by natural draft to carry off unburned fuel.

While this type of device is accep-

Adapted from a paper presented at a meeting of the Midwest Industrial Gas Council in Rockford, Ill.

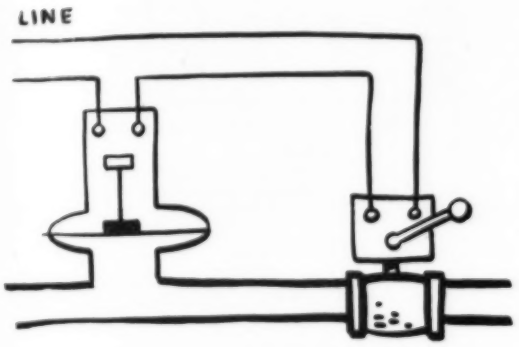


Fig. 1. Pressure switch is mounted on fuel supply line and connected to a valve. When pressure drops below pre-determined setting, valve closes to cut off fuel.

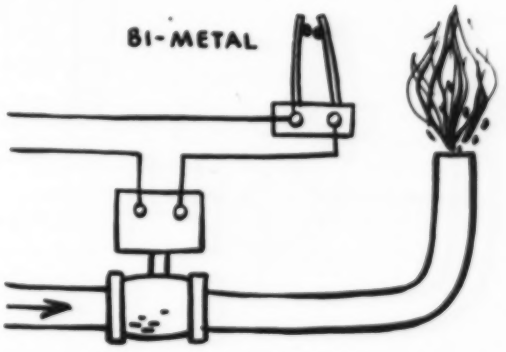


Fig. 2. In event of flame failure, bi-metal strip cools and opens contacts, which causes valve to close. Device may take permanent set if subjected to high temperature.

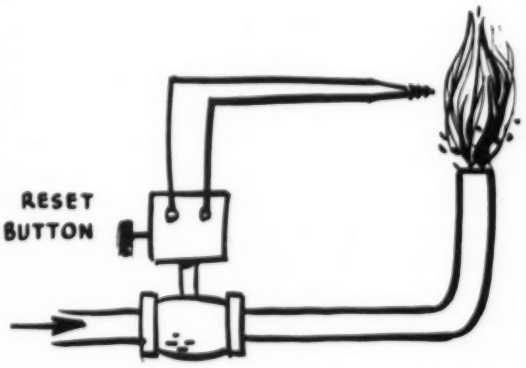


Fig. 3. Thermocouple senses presence of flame. Electromotive force is generated when one junction of thermocouple is at different temperature than the other.

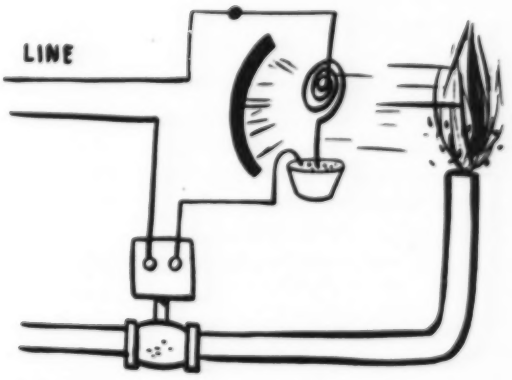


Fig. 4. In the radiation system energy from flame strikes curved reflector, directing light toward bi-metal, which warps. This causes contacts to close circuit.

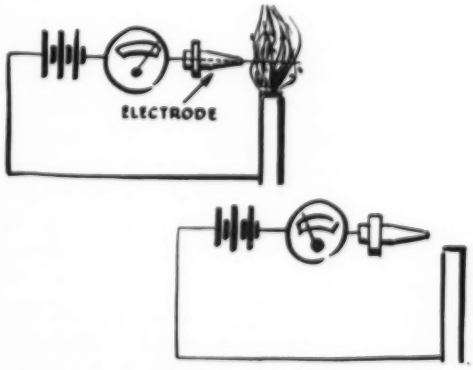


Fig. 5. Protective device can operate on principle that flame conducts electric current. When flame is present, current flows through it, causing meter to deflect. When flame is not present current does not flow. Meter then rests at zero.

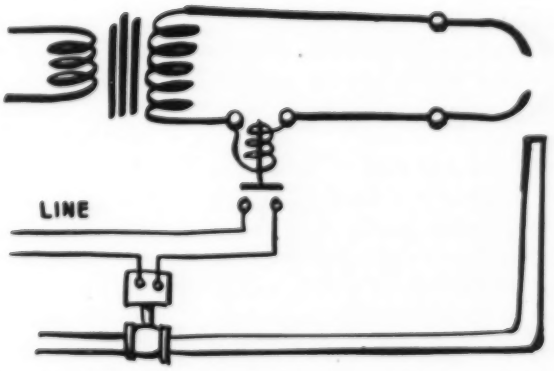


Fig. 6. Presence of flame causes current to complete circuit between two electrodes. Relay coil is energized as long as flame is present. Contacts of the relay are connected to a valve system. Flame failure causes valve to close.

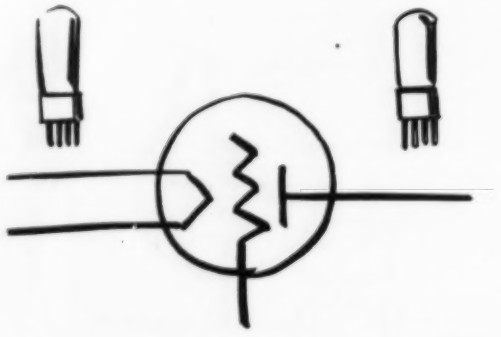


Fig. 7. In electronic systems, sending units have been devised that operate on the flame directly and do not react because of thermal change. Closing of control valve is instantaneous.

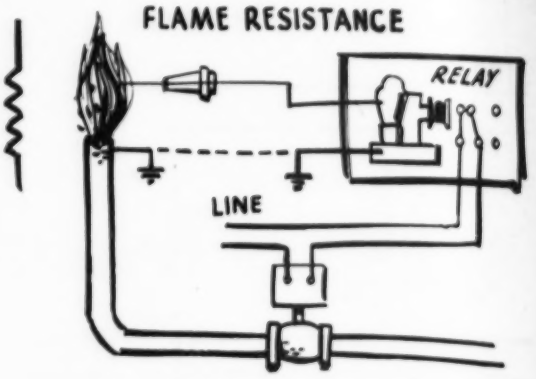


Fig. 8. Electronic circuit detects change in resistance of flame to current, and operates relay. Resistance to current is within close range of all flames; circuit accepts only this range.

able on the smaller gas burning appliances there are some considerations that should be remembered when using these devices. As they are heat-sensitive type devices, the response time may be relatively low. In other words, the time delay or lag from the time the flame fails or is extinguished and the actual closing of the valve itself may be rather long. Metal which is close to the sensing unit will also be hot and in the event of a flame failure will cause a delay in the rate of cooling to prevent an instantaneous response of the combustion safeguard.

On most small applications, if properly vented, a lag time of up to two minutes is acceptable. That is, the flame could fail and there could be a delay of two minutes before the valve itself responded to the flame failure and closed. Because of this time lag most of these appliances carry a warning sign and a note of caution is included in the instructions that the unit should be vented for approximately five minutes before an attempt is made to re-ignite the flame. Should there be an accumulation of gas, the natural draft would carry off the unburned fuel before an ignition means was introduced into the combustion chamber.

Another method used to detect the presence or absence of flame as applied to combustion safeguards is radiation *(Fig. 4)*. The unit is directed toward the flame so that the light or radiant energy from the flame will strike a curved reflector. The curved reflector directs this light toward a bi-metal where it is transformed to heat and the bi-metal will warp. This will cause a set of contacts to make and close an electrical circuit which will energize a fuel valve.

The devices mentioned thus far are essentially mechanical devices that respond because of a change in heat. Combustion safeguards or protective devices have also been developed that operate on the principle of the characteristic of a flame to conduct an electrical current. This principle could be illustrated by means of a battery which is placed in series with a flame along with suitable electrode and a meter. When a flame is present, current would flow through the flame and cause the meter to deflect.

When the flame is not present current flow would stop, in which case the meter would fall to rest at zero *(Fig. 5)*. As this principle requires that the flame itself complete the electrical path and that a suitable electrode be inserted into the flame, it is generally well suited for use on gas flames.

Use of electrodes

One such device available uses two electrodes to which approximately 5000 volts is applied *(Fig. 6)*. There is sufficient spacing between the electrodes so that an arc will not be formed; however, if a flame is present, it will aid the condition of current which will result in a completed circuit between the electrodes. Because of the current flow between the electrodes the relay coil will be energized as long as the flame is present. The contacts of the relay can then be connected to a valve system and cause a valve to close in event of flame failure. Such a device is made by the Partlow Corp.

The trend in recent years has been to use electronics as a means of detecting the presence or absence of a flame *(Fig. 7)*. Suitable sensing units have been devised which operate on the flame directly and do not react because of a thermal change. Because heat is no longer a factor, operation to close control is practically instantaneous.

These units are most commonly applied to applications found in the industrial field. Single burner operations in the industrial field can approach such capacities that they will burn 10 million Btu per hour and be supplied through approximately a 6-in. gas main.

The need for a fast responding, dependable combustion safeguard and protective devices is apparent. In event of a flame failure it is desirable that a fuel valve be closed immediately rather than have a time lag before the valve is actuated.

The application of electronic equipment is not confined to large industrial applications. Smaller fuel burning devices use it as well. Personnel working in the vicinity of baking ovens, core ovens, paint drying ovens, and similar equipment operating in an enclosed area constitute a liability in event of an explosion. In addition, there are processes that may give off a combustible atmosphere which will add to the danger of a serious explosion.

There are three basic electronic systems that are currently employed and offered by various manufacturers. There is need for each of these systems. While in many cases any of the three systems could be used, a choice is desirable either because of cost or ease of application.

The first of these systems utilizes the principle of a flame to conduct the current but does not require the higher voltages necessary on the system just discussed *(Fig. 8)*. While a flame has a characteristic of conducting a current, it offers a resistance to that current. Combustion safeguards are available

Combustion safeguards... All flames have a resistance to a current within a close range

that use an electronic circuit that detects this change in resistance and in turn operates a relay. The various flames all have a resistance to a current within a reasonably close range. The electronic circuits accept only this range to actuate the relay with a flame present and will reject resistances outside of this range. This is the case when no flame is present as infinite resistance is then approached.

The lower operating limits of such a circuit are also limited to reject a ground-out resistance. It is possible for an electrode to contact ground directly. This could be caused by misapplication, shifting of the electrode rod, or extreme heat, which in turn could cause a rod to sag and contact ground. This would also complete an electrical circuit and could actuate the relay. By proper design the electronic circuit rejects this ground-out current because the resistance is too low.

This conductivity system using resistance of the flame to actuate a relay is generally quite easy to apply and will operate satisfactorily over a wide range of flame. Because of the characteristics of most oil flames, a photo-cell is used in place of an electrode rod. The photo-cell sights directly on the oil flame and actuates the electronic circuit in the same way as the electrode. Depending on the type of flame, either a blue sensitive or a red sensitive cell is used. Usually a blue sensitive photo-cell is better suited to the larger industrial applications.

Another system available also uses the characteristic of a flame to conduct the current, but operates by rectifying the current through the flame *(Fig. 9)*. This rectification system also employs an electrode rod which is inserted in the flame. By controlling the amount of flame that strikes the flame rod with respect to the area of the flame that contacts ground, the current passing through that flame will be rectified. The electronic circuit will actuate a relay when there is sufficient rectification of a current through the flame.

Because of the necessity of maintaining this ratio, there are times where this system is somewhat more difficult to apply than the first of the electronic systems discussed, but much of this can be overcome through proper design of a burner and electrode assembly. This system can also employ a photo-cell for use on oil flames.

Either of these two electronic systems in most cases would call for two sensing units if used on combination oil or gas burners. A rod would be used for sensing the gas flame and a photo-cell would be used for sensing the oil flame. This is a generally followed practice; however, there are exceptions where it is possible and practical to use a rod on an oil flame and a photo-cell on a gas flame.

In many instances where these electronic systems are used, the reaction time is so fast that the electronic circuit has to be slowed down. A time delay can be inserted into the electric circuit to avoid the difficulty that might be experienced because of nuisance shutdowns caused by relatively minor flame fluctuations that would not necessarily be of a hazardous nature. The laboratory of Associated Factory Mutual Fire Insurance Companies has found that it is acceptable to have delays between two and four seconds to overcome the problems that would be presented because of nuisance shotdowns, as there are times when process interruption is costly.

A third system is that which operates on the principle of responding to infra-red radiation *(Fig. 10)*. It has the advantage of employing very small sized sensing units, which in turn simplifies the application.

The small sized sensing unit is approximately ⅜ in. in diameter and contains two small electrodes. This cell is coated with some material such as lead sulfide. The electronic circuit then senses the change in resistance of a current placed across the electrodes. When no flame is present, the resistance of a small current applied to the electrodes would be relatively high. When the cell is subjected to infra-red radiation, the resistance will drop, which in turn will permit a greater flow of current. It operates because of a change in ratio of dark resistance when no flame is present to light resistance when exposed to infra-red radiation.

This change is also combined with that of a cycling, pulsing or flickering of a flame. As a flame burns, it pulses or fluctuates and the electronic circuit is designed to accept the combination of change in resistance of the cell along with the frequency of pulsing. The rate of intensity fluctuation is approximately the same regardless of the type of flame.

This single unit has the advantage of responding to both gas or oil flames satisfactorily and avoids the necessity of using two sensing units on combination

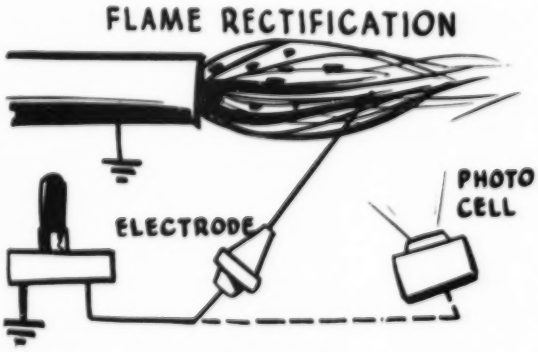


Fig. 9. Rectification system employs electrode rod which is inserted in flame. Sufficient rectification of current through flame causes electronic circuit to actuate a relay.

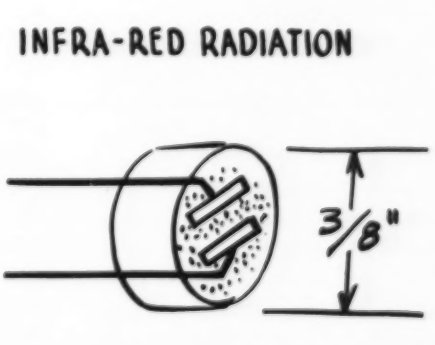


Fig. 10. Application of infra-red radiation system is simplified because system uses small sensing unit containing two electrodes. Circuit senses change in current resistance.

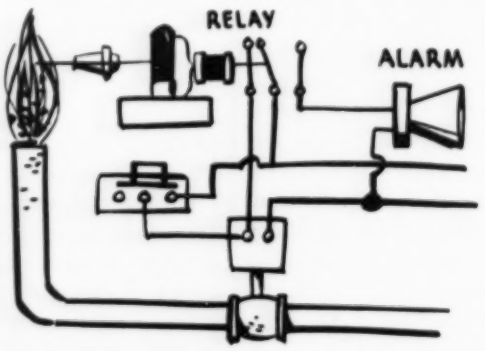


Fig. 11. An alarm signal could be incorporated into electronic systems so that when relay is de-energized, alarm will sound, indicating that flame is out.

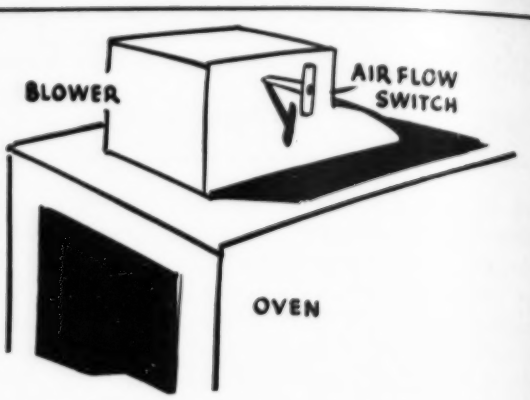


Fig. 12. Time delay unit in conjunction with air flow switch is used to insure three complete air changes in paint or core drying oven before flame is ignited.

burners. As background light may have a good percentage of infra-red radiation, it does not affect the electronic circuit because it will not have this frequency of pulsing which the flame itself would have.

In addition to the sensing means described, additional work is progressing to determine and discover even more or other means of detecting flames for use in combustion safeguards.

Along with the various means used to detect the presence or absence of a flame, consideration should be given to other factors which affect safe operation of a complete system in order to take advantage of maximum safety.

Electronic systems

In the case of electronic systems, it has been shown that they are means of actuating a relay. This relay would have contacts which would be properly connected to an electrical circuit to complete the combustion safeguard system. Some of these systems are relatively simple and can be met by proper use of available relay contacts. These systems would be essentially manual in operation in that an operator would manually start the initial flame through use of a hand torch or by means of a push button and electric ignition. When a flame had been established, the relay and the combustion safeguard would be energized, which in turn would close an electrical circuit to keep the valve in the open position. The flame would burn continuously throughout the process operation and in event of flame failure the relay would be de-energized, which would close the valve. An alarm signal could be incorporated so that when the relay is de-energized an alarm will sound which will indicate that the flame is out *(Fig. 11)*.

A more elaborate system that is required when applying combustion safeguards to processes that give off a combustible atmosphere, such as paint or core drying ovens, requires the addition of a purging or scavanger period. Safety rules are such that three complete changes of air through an oven are generally required before any attempt can be made to ignite a flame. This can be accomplished by means of a time-delay unit, which is used in conjunction with an air flow switch *(Fig. 12)*. When there is movement of air through the oven, the air flow switch makes a set of contacts which start timing of a time-delay unit. After the expiration of this time, which in most cases is approximately five minutes, the time-delay unit will then permit the flame to be established manually.

There are also applications that call for more elaborate programming, which requires that a pilot flame be established automatically after a purging period. Then the automatic program continues to open a main fuel valve once a satisfactory pilot had been established to complete the cycle. When satisfied by pressure or temperature controls, the complete combustion of the system stops and no flame is present. When again there is a demand for more heat, the complete cycle is repeated automatically. There are many types of programs required and available to meet the demands of various processes and applications. The combustion safeguard will be interlocked with many other controls and protective devices.

There are a number of ways of detecting the presence or absence of a flame and there is need for all of the methods discussed. In the use of combustion safeguards it is desirable to follow the recommendations of the manufacturers of the various equipment. This applies to any type of combustion safeguard system.

It is possible to obliterate many of the advantages of a combustion safeguard by poor application practices. Sensing units can be so positioned that they will not permit operation at all or, at the other extreme, permit hazardous operation. The same applies to electrical circuits. There are times when all the safety that is possible from a combustion safeguard has not been achieved because of poorly designed and engineered electrical circuits and the way they are used with auxiliary equipment.

Operator education

There is also a problem regarding operator education or instruction. Unfortunately, explosions have occurred not because of failure of the combustion safeguard itself, but because of poor application or insufficient knowledge on the part of the operator.

Combustion safeguards and protective equipment are becoming more and more necessary. There are many means available of detecting the presence or absence of a flame. While there is considerable overlapping in the range of the various systems, good judgment should be exercised in the choice of system as well as in the application of sensing units. Consideration should be given to the installation and maintenance of equipment, in order to get the maximum safety that is possible. It is a good policy to follow the recommendations of the manufacturers of combustion safeguard systems. ■

Major highway crossed without serious traffic lag

General view of the boring operation and equipment. Two portable air compressors, one trailer-type and one truck-mounted, furnished compressor air to the drilling unit motor. Winch truck, to the right, pushed the casing and boring equipment into the hole as the cable was reeled in. End of cable was fixed to dead-man at the face of the bore.

Boring unit in place and making hole. The air motor-powered unit rides on the track shown. Drilling unit, track, and casing are pushed into the bore as a unit.

WHEN Public Service Co. of Colorado tackled the job of supplying gas to the town of Broomfield, a major highway crossing was necessitated. The Denver-to-Boulder turnpike, a major artery in the Colorado system, lay across the path of the system.

An outstanding example of earth boring, which gobbled up a core of dirt 9 in. in diameter and 112 ft long, was accomplished in short order. Moving at a rate of from 8 to 12 in. per minute, a Ka-Mo earth auger completed the bore within a matter of hours without serious interruption of traffic.

Design of the Broomfield distribution system specified that a 6-in. mill-wrapped line be installed in an 8-in. casing at the highway crossing. This link was part of the over-all job calling for construction of a 2-mile Colorado-Wyoming Gas Co. pipeline extension, a new town border station, 400 ft of 6-in. main, 400 ft of 4-in. main, and 10,000 ft of 2-in. main. Technicians from Ka-Mo Tools Inc. made the bore to demonstrate newly purchased drilling equipment to the personnel of the various divisions of the utility.

The Ka-Mo drilling machine uses a sectionalized earth-auger type drill for horizontal drilling. The boring unit is track-mounted and drills through the casing that is to be installed; in this instance, 8-in. casing was selected. A Gardner-Denver 10-hp air motor drives the boring machine. Compressed air is supplied by portable air compressors; in this case, two 105-cfm compressors were used. The drilling unit, track, and casing travel as a unit during the actual drilling.

A dead-man was installed at the face of the bore; from this point, a spun-wire cable extended to the far end of the casing, to the front, and from there to the drum of a truck-mounted winch. As the winch reeled in the cable, the casing, boring machine, and track were thrust into the bore as the drilling head penetrated. Since 8-in. casing was being installed, a wing-cutter-equipped head was used to bore a 9-in. diameter hole. In this way, the casing was installed as the bore progressed. When completed, the bore-hole measured 112 ft.

Boring head and casing emerge from the terminal end of the bore. The 8-in. boring bit was equipped with wing cutters to produce a bore slightly larger than 9 in. to accommodate 8-in. casing.

In the two symposiums* that GAS has conducted on the subject of digital computers, it has become obvious that total agreement is lacking as to the best applications of computers. Companies using them, or contemplating using them, differ sharply in theory and practice; and obviously, the problems or organization differ as much as do the potentialities of each application. These problems—and these potentialities—should be recognized before a decision as to the desired usage is reached.

Applications include:

(1) Research activity.

(2) Combination usage, with a central computational facility that can be called upon to solve gas engineering problems as well as to handle data-processing work for the business function (i.e., accounting, billing, etc.) of a gas company.

(3) Design and operating functions of the engineering department.

At this half-way point in the five-part GAS series, the problems and potentialities have been rather clearly brought out by the symposium participants. Further consideration will be given them in a later installment.

*March 1955, starting on page 43, and May, starting on page 44. (The introductory article appeared in January, starting on page 109.)

DIGITAL COMPUTERS

Part 3. Where gas companies use them; Storage system developments

By J. FRED EBDON • Managing Editor

Research installations

MOST separate, company-owned research facilities in the gas industry are maintained by major pipeline or integrated gas companies and are concerned with projects originating from exploration, drilling, reservoir analysis, production, processing, transmission, and distribution in the natural gas operations. Thus, a variety of problems involving practically all of the physical sciences are available.

The electronic computer installed in a gas company research laboratory is not usually applied to problems that can be solved by routine calculations of a similar nature; rather, there is generally a flow of problems of all kinds to the computer. Each problem, then, may have to be solved with the following sequence: First, the physical problem must be stated mathematically; then, an analyst prescribes the numerical methods by which the machine can yield the desired results from the available basic data. Next, a program is prepared to outline the strategy to be followed by the computer; following this step, a code must be formed to write the specific instructions for the machine. Frequently, the next step is the correction of errors in the coding.

From a computer group, all of these functions are available to each researcher working on projects at the facility. The complement of the computer section must be versatile as it usually is not practical to have a staff member for each computer preparation function. The computer staff, usually relatively small, has people who can analyze, develop the numerical methods, code, program, and correct as needed. Needless to say, it takes a highly competent and thoroughly trained mathematician to become fully effective in this field; however, a research organization should have more of such personnel than any other segment of the gas industry. The mathematician usually works out better in the research field than the engineer; perhaps this is because to an engineer the fields of electronics, elasticity, fluid mechanics, etc., look very different. To an applied mathematician, however, they have strong similarities.

In each scientific field, there are problems covering a great range of complexities whose mathematical statements are similar. For example, the determination of the equilibrium stresses

GAS staff report

and positions of loaded rods joined non-rigidly at specific points is a basic problem of structural or stress analysis (elasticity). Most applied mathematicians would consider this problem not too far afield from the mathematical considerations argued for solution of fluid networks and certain electronic networks. The Hardy-Cross method of network analysis, used in the gas industry, began in the field of structural analysis.*

It should not be concluded, of course, that only mathematicians will find a successful career in this field. Actually, as I see it, there will be (and is) a need for engineers with an extensive background in mathematics and for mathematicians with a similar background in engineering problems.

A gas industry research organization can use its computer to investigate research mathematics. This is being done in most cases. There is sufficient need for computers to be used for basic exploration of theory and techniques to warrant this. For example, considerable work is being done toward obtaining more efficient solution methods for simultaneous non-linear equations. Techniques for handling these problems have been developed; however, there is still much to be done. In addition, there are serious problems in existence in the numerical solution of ordinary differential equations with two-point boundary conditions, the solution of partial differential equations with boundary conditions in the wide field of integration, and in characteristic value problems arising in ordinary and partial differential equations. Researchers in the gas industry work on mathematics for those problems where effective practical application of computers is not practical until methematical solutions or methods are developed.

Computers add a completely new tool to the extensive equipment of most gas industry research laboratories. In the past, it was impractical to work some of the problems encountered because of the complexity and volume of the mathematics; that is, it is not the usual practice to use the skilled researchers for routine computations when they can be doing important experimental work. Computers allow problems to be solved that were never before accurately solved because of the tedious calculations necessary. This computational aid allows research work to be placed on a selective basis; that is, numerous approaches can be taken without too much expenditure of time, probabilities can be worked out, and extremely large volumes of data can be handled. These are important to research.

*GAS, May, p. 50.

In a later issue, GAS will bring to its readers some first-hand information on what a computer has meant to a specific gas industry research facility.

THE "combination" computer facility has been found to lend itself well to gas company operations. Most of these are machines installed in the business section of the companies and are used jointly by the engineering or other technical departments; however, at least one major transmission company has a computer facility that is organized to handle computations for any department in the company.

The usual procedure under a combination set-up is for the department that has a problem it feels is applicable to computer solution techniques to take it to the computer section supervisor. There, the problem is analyzed and a decision is made as to the practicality and economy of using the computer for the solution. If it seems advisable to use the computer, all the preparation can be done in the computer section by personnel trained for this work. There should be economies in this system if the personnel involved are versatile enough to have a good background in the many technical phases of gas operations, business as well as scientific.

Business problem solutions in some respects closely resemble those for technical problems; in other respects, they differ vastly. The steps for preparation of data for the computer are practically the same, but the techniques needed for taking each step are usually quite different. Programming for a business type problem may be quite different from programming for an engineering problem. For a business problem, the mathematical investigation is usually relatively trivial, but there is generally a complex problem of gathering large amounts of data or arranging for the flow of a large volume of data. On the other hand, an engineering or scientific problem usually requires considerable mathematical research to formulate a mathematical model of the problem.

The business problem will probably involve a mass of input and output data with relatively few calculations; the average engineering problem involves relatively small volumes of input and output, but usually requires considerable calculation. In both types of problems there is the same need for teamwork and communications between the originators of the problem and the computer section personnel. This is important; the computer personnel should try to "educate" the other departments along the lines of what the computer will mean to computational processes of a particular department. In this way, the personnel of the various departments will be able to get other problems in the routine of their work that could be applied advantageously to the computer.

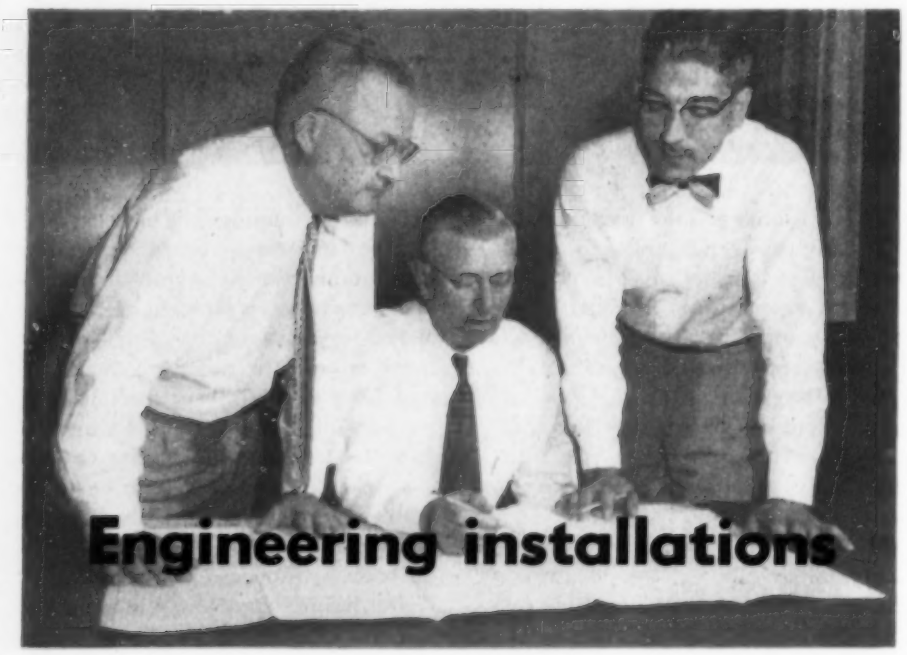
Conversely, the computer personnal

Digital computers... Table preparation can be, and has been done, with digital computers

should take the time to look into the operations of the various departments so that they can gear their work to produce solutions that fit into the already developed procedures and methods. Too often a computer group produces a neat solution to a business problem and reads it out in a form that is not compatible with accounting and/or billing procedures. There is no economy in this if the business department has to take the read-out data and do a lot of work with it before it can be integrated with established procedures.

A central computing service should be better able to analyze a problem and determine if its major effort should be focused on computer calculation speed or on developing techniques and speed for data-gathering and handling. The need for the central facility becomes obvious if study reveals that the loading by any one department would not require full use of the computer's time.

More of the fine points of operating computers under a combination or central computer service set-up will be discussed in a coming symposium.



Engineering installations

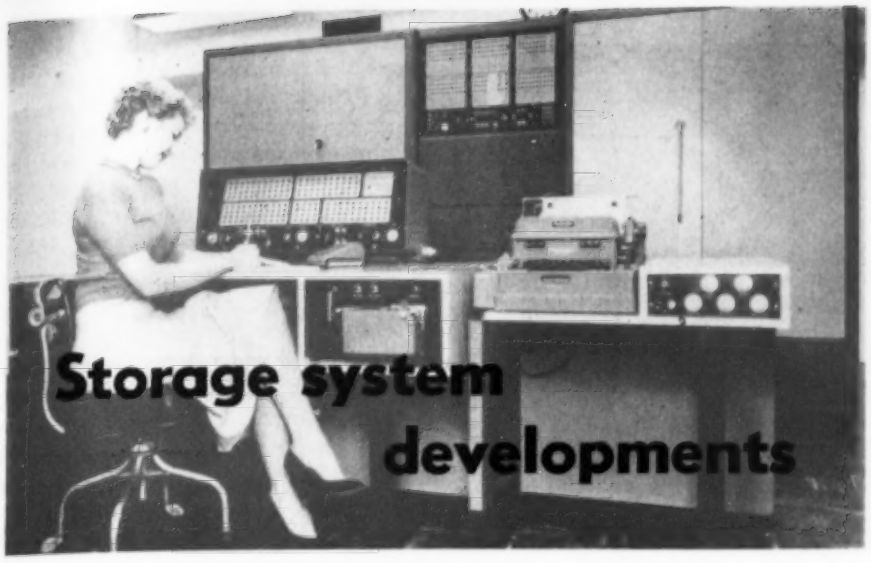
MANY experts take the approach that an engineering department cannot justify a computer for restricted use on solution of engineering design and prediction problems. In some cases, however, this conclusion has been reached on the basis of the volume of work that could be immediately applied to the computer on installation. In practice, however, the installation of the machine for engineering problems alone will stimulate the thinking and the foresight of personnel involved, so that many additional uses will be developed.

It is well known that an engineering computer installation speeds calculations to the point where executive decision can be made on the basis of many different designs rather than several that may be produced by laborious hand calculations. A growing company can save money by being able to find the most economical design from a large group.

Table preparation can be, and has been, done with digital computers. The engineering departments are usually more "table-minded" than others because they are schooled in the use of tables, estimating rules of various types, and other short-cut computational aids. One who has worked in a gas company has likely seen the many technical tables that engineers develop or cut out of publications and stick on the walls or slip in their desks for quick reference and estimation. Also, some companies have frequently used tables printed and distributed. Computers can produce tables in very little relative time. For instance, one company prepared a table of combination temperature-density factors for positive meters on a computer. A pressure base was used, and the absolute pressure from 15.73 to 375.23 psia was taken in ½-lb increments. Temperatures from 10 to 90° F were used for each ½-lb step. The company estimates it would have taken 650 man-hours to produce this table by grinding it out on desk calculators. With a computer, it took six hours to set up the program, 12 hours of actual calculating in the machine, and 14 hours for printed read-out. This was, of course, a special job, but it illustrates the point that an engineering department can use its machine for a variety of minor applications in addition to the important design, construction, and operating problems.

Just where the utility of computers in engineering departments will end is hard to say. With the research work being done to develop bigger and better computers and more auxiliaries, tomorrow's pipeline could operate almost completely automatically. It is possible to have remote data logs, temperature and pressure scanners, sequential data recorders, analogue-to-digital converters, etc., placed at strategic points in a gas distribution or transmission system so that data on the system's operation can be fed into a digital computer as desired. This would merely be an act of collecting many variables of the system, measured at many points, at one central location. The calculator could then be programmed for the best solution, operations-wise, for each set of conditions read in periodically. The solution or output could then be fed into digital-to-analogue converters that could activate starting mechanisms, valve operators, motor levers, and, generally, change the set points of the pipeline or distribution process to produce the optimum conditions in the system. This rather spectacular idea may be a bit fantastic but it may yet come.

This and many other concepts will be discussed in future symposiums. Some of the subjects that keep popping up are: leased vs. company-owned computer facilities; engineering department vs. outside (consulting) programming; the general purpose vs. the specialized computer; the use of manufacturers' training schools; and the need for courses on computer operation and techniques in colleges and universities.



Storage system developments

COMPUTER developments in the past few years have been generally based on the improvement of information storage devices—the "memories" of the machines. As computer techniques have developed, the need for more efficient memory devices with larger capacities became evident.

As an example of the memories that have been used, a pair of vacuum tubes has been arranged in circuitry so that the pair have two stable states. One state stores "zero" and the other stores "one"; this is called a "flip-flop" and by combinations of flip-flops, any number can be stored. (The information stored in a flip-flop is a "bit" or binary digit.) Other computers store a bit as a compression wave in a pool of mercury, and still other machines are designed to store a bit as a charged spot on a cathode ray tube. Another widely used storage method employs a rotating drum or magnetic tape, and the information is stored as a magnetized spot thereon.

The "flip-flop"

The flip-flop—often called "toggle" because it is analogous to a toggle switch which is either "on" or "off"—can be made with static storage of a bit in a condenser, a magnetized core, or transistor. There have been many different types of memory systems suggested and there are many ways of making most of the systems with various components. It is difficult to comprehend just what the memory of the future may employ.

Modern computers need a main memory that has a very rapid access time, and permits the stored information to be rapidly erased. This memory is used to store the data and instructions being actively worked on by the arithmetic or other unit. An intermediate-speed memory may also be included in the computer to provide the main, larger storage capacity, but with a slower access time. This memory usually also has the ability to rapidly erase the information stored in it. The third type of storage encountered can be thought of as an auxiliary memory that provides "space" for a huge number of words that are only indirectly available, in a definite order, for calculations and, as a result, have relatively slow access time.

Magnetic drum

Modern, general purpose computers seem to rely on the magnetic drum for intermediate-speed or main memory. The drum surface is coated with a ferromagnetic dispersion similar to that used on the tape of a magnetic recorder. The drum is rotated at high speeds—3600 rpm, for example—and electrical heads capable of reading and writing information are located at close intervals along the drum, so as the drum spins, each head has access to a small loop of information that extends around the circumference of the drum. In some computers, the heads are fixed and positioned about 0.001 in. from the drum surface. This results in a relatively slow access time because the computer must wait until the information wanted passes under the electrical reading head so that it can "catch it as it goes by," as it were. This access time might be as high as 20 milliseconds.

The high-speed memory units have received a great deal of research and development attention. A typical computer has a "quick access" storage that is a separate section of the main memory drum. Four pairs of read-write heads are arranged around the drum. As the drum rotates and the four bits of each decimal digit appear under the reading heads, the bits are amplified, reshaped, and sent back to the writing heads. The quick-access band has four loops, each of which can store 20 words, so the 80 words in the section are continuously circulated as the drum rotates. Thus, the information is available in either direction at any single word-position in 0.85 milliseconds.

High-speed memories

Recent research into high-speed memories involves the use of little ferrite donuts, called "cores," which are magnetic. The cores have the characteristic of being able to respond to its magnetic state after the magnetizing field is turned off. Magnetize a core in one direction and its state represents the bit 1. Zero is represented if the core is magnetized in the other direction. If the core has been magnetized in the state or direction representing 0 and a field is applied that would produce the magnetic state representing 1, a change in magnetic state would be experienced, and the change would produce a signal current in a wire threaded through the core; thus, the generated signal shows that the core is storing zero. If the core was magnetized in the 1 state and a field that would produce the 1 state in an unmagnetized core was applied to it, there would be no signal generated and the lack of a signal indicates that 1 is being stored. This magnetic core flip-flop system seems to have promise because it has some immunity from electrical interference, produces a good, strong signal, and the circuitry involved appears to be relatively simple.

Another experimental high-speed memory system uses barium titanate crystals with lines etched on top and bottom in different directions. This material is ferroelectric (rather than ferromagnetic, as in the case of the magnetic cores) and "remembers" an electrical property, bias, rather than its magnetic state, as voltages are applied. It is reported that a ⅛-in. square crystal can produce the storage capacity of 256 vacuum tubes.

The large-capacity or auxiliary storage devices have not received the extensive research effort of the main and

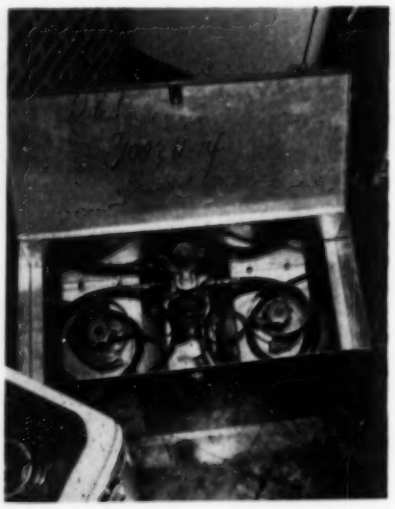
W. B. Ciprella, utilization engineer at Equitable, shows the ease with which gas appliance demonstrations are set up with the portable container he designed. Two gas ranges are supplied with LPG at the same time, with no additional fittings necessary. The aluminum box has handles on each side and a locking latch.

Portable LPG container used to demonstrate gas appliances

A SAFE and convenient means of supplying fuel for gas ranges and refrigerators used in cooking schools, appliance demonstrations and other off-the-line uses, has been developed by utilization engineers of Equitable Gas Co., Pittsburgh.

A compact, portable case enclosing bottled liquefied petroleum gas and all necessary control and regulating fittings was designed at the request of the safety division by William B. Ciprella of the utilization engineering division.

The advantages of this portable container are readily apparent when it is compared with former methods of arranging for supplementary gas supplies where natural gas is not immediately obtainable, such as school auditoriums, hotels, department stores, and theaters.



The interior of the portable container, showing the two 20-lb LPG tanks.

For instance, an appliance service crew had to be provided to get bottled gas and install improvised connections for each demonstration. Sometimes copper tubing was strung for many feet into the building from outside gas supplies. Often the request for a demonstration set-up did not provide sufficient notice, and this required a shift in work schedules in order to set up the gas supply. When bottled gas was used, tank installation was unavoidably makeshift and lacked adequate safeguards against accidental damage and tampering.

The new container eliminates these disadvantages. It is made of aluminum with a fire lid and has handles on each side for ease in carrying. Its two 20-lb L. P. gas tanks work automatically; a regulator switches from an empty tank to the full one. A red marker shows that one tank has been emptied. The handy underwriter-approved flexible connectors, equipped with couplings, make it unnecessary to improvise installations when a demonstration is planned. And when the unit is not in use, a valve is closed, a hose disconnected, and the container is locked.

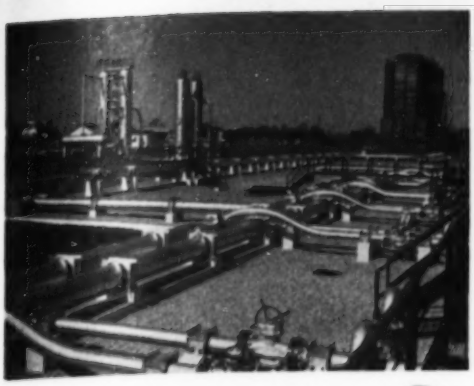
The overall cost, including two full tanks, is $118.

Safety and fire prevention were first considerations in designing the LPG container, but great convenience and financial savings in labor costs have resulted from its use. It is no longer necessary to negotiate between two departments of the company when a demonstration is planned, and the question of available fuel supply can be disregarded in booking and installing demonstration facilities.

high-speed memories. Many modern computers have, however, replaced punched card storage with magnetic tape. Most machines allow for connection of one or more magnetic tape units to them to provide huge reservoirs of slow-access storage. Some units use multiple, parallel channels on a single tape; others use several parallel rolls of tape; and some use extremely long rolls of tape in the magnetic tape auxiliary storage unit to produce a large memory capacity. Other memory devices, such as the experimental "photoscopic" method, are being studied.

It should be obvious that the technical developments in the computer field seem to be getting ahead of the art of application. It is easy to find out what a computer will do. One can simply ask the manufacturer what the mean random access time is, what the input and output speeds are, whether the arithmetic unit operates in series or in parallel, what the basic pulse rate is, etc., and the answers are readily available. The missing link is the person who can tell gas industry management what machine will fit his needs and how to apply this machine after it is purchased. The mystery of computers from the point of view of the supervisory level engineers is how to put a problem on this electronic contraption.

The answers lie in training mathematically inclined engineers or hiring mathematicians with engineering and computer operation backgrounds to set up and operate computers as a routine gas industry tool. But there aren't enough personnel with these qualifications available. Therefore, gas companies will either bid against other industries for the computer technologists or forget about computers for years to come. We don't suggest that every gas company should jump into the middle of this newest "industrial revolution" for that would be an expensive folly, but we do suggest that some hard-boiled companies that are conservative with their dollars have made computers pay out. We believe that each gas company should be aware of the fact that in its operations, where numbers are involved, a company should at this time study its own computational requirements and take the initiative in setting up a long-range computer program or run the risk of missing or delaying the benefits of a dynamic device which indicates to leaders of industry that the scale of its future applications is much greater than is generally realized today. ■



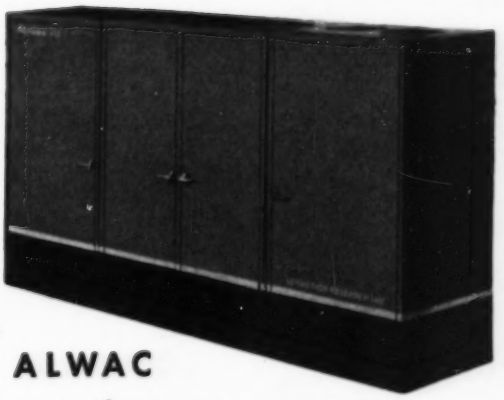
It's time to decide....

Electronics is speeding Gas Technology Progress

Gas engineers face important decisions as gas consumption increases in a growing variety of uses across the nation. Problems in research, transmission, production, and distribution have outgrown mechanical methods of computation. To obtain answers to hitherto "unworkable" problems, far-sighted gas industry leaders are looking to electronic digital computers. These machines solve complex problems at high speed and also take over routine, time-consuming calculations efficiently and economically.

At the Institute of Gas Technology in Chicago, the ALWAC III, a low-priced digital computer, takes only three to five minutes for computations on mass spectrometer data which took one to two man-hours on an analog computer. The Institute is programming other problems for comparable time-saving on the ALWAC. Application Engineers of Logistics Research Inc., manufacturers of the ALWAC, will be pleased to survey your data processing needs and show exactly how the ALWAC can best serve you.

The time to decide is now!



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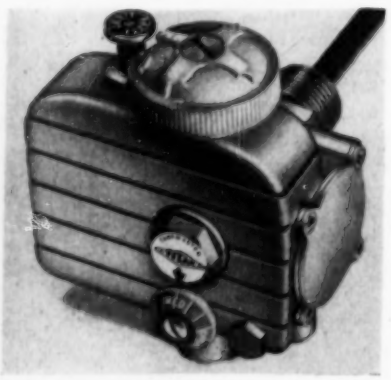
GAS new products

To secure further information on products or new literature, simply fill out the coupon and mail, indicating by number the information or literature needed.

1 Water Heater Control

The Titan Tankmaster Model C-100, a redesigned version of water heater controls C-40 and C-50, features a high strength alloy of aluminum for the body with a brass boiler shank. The casting has very high strength, excellent finish, extremely low porosity, and high resistance to fracture. It is the type of casting a water needs to insure a dependable and rugged thermostat.

The main valve is now of the "soft" type, using a Buna H-84 material that will not dry out, swell, crack or craze due to severe gases. The main valve, easily removed for inspection simply by removing the hex valve cap, is opened and closed by the exclusive Titan toggle mechanism. With this mechanism, throttling of the main valve is eliminated and the main burner is either full on or completely off. The mechanism is constructed of alloy steel parts, case hardened to insure long life and accuracy. All parts are plated to insure resistance to corrosion. All hand wheels and temperature dials are high strength metals.



The magnetic shutoff provides 100% shutoff and is easily removed in the field. The thermostat incorporates true 100% safe lighting easily understood by any housewife. It is impossible to light the pilot without turning handwheel to the "Pilot" position.

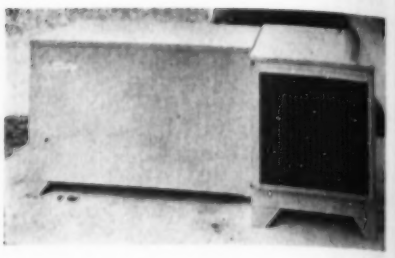
The thermostat includes the large type pilot filter, with the pilot adjustment downstream from the filter.

The C-100 is simple to recalibrate since the temperature dial turns through an arc of 345°. This greater arc allows the serviceman larger tolerances in recalibrating the control and eliminates any critical adjustments.

The thermal tube is joined to the shank by a close tolerance taper thread, then soldered by an induction process to insure a tight and waterproof joint. After soldering the control is tested under 175-lb pressure to eliminate any possibility of a water leak.

Titan Valve & Manufacturing Co.

■



2 Gas Air Conditioner

The new natural- or L.P. gas-driven Cobaire air conditioner produced by Cobell Industries Inc. uses a new application of a well-established engineering principle: A gas-powered reciprocating prime mover and a standard air conditioning compressor is coupled by means of a centrifugal dry-type clutch. The clutch permits the prime mover to attain a speed of approximately 1000 rpm before engaging the load of the compressor. The starting torque requirements are eliminated, permitting a reduction in the size of the prime mover both in horsepower rating and in physical dimensions. Further reductions are made possible by the use of Cobell's Aqua-Fog evaporative condensing of the Freon refrigerant, a rapid-heat transfer process. The unit is said to produce 1 ton of refrigeration per 1 hp.

Manufacturer claims that the Cobaire is operated by natural gas at less than 5½ cents per hour. No maintenance at all is necessary in an average 2200-hour season and the total operating cost is less than half that of a standard electric model, according to the company.

Production will be concentrated primarily on models of 3- to 10-ton sizes at first.

Cobell Industries Inc.

■

3 Air Compressor

The Jaeger Machine Co. has announced an improved type of two-stage oil cooled rotary air compressors in 125- and 600-cfm sizes. In addition to the characteristic rotary advantages of fewer moving parts, lighter weight, cooler air temperatures and complete absence

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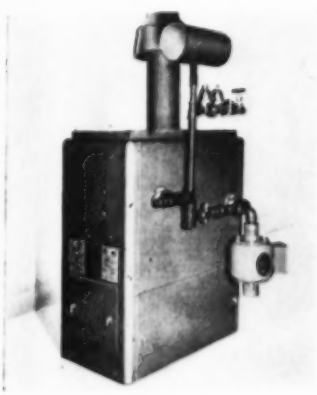
of vibration, the efficiency of the Jaeger Roto design is evidenced in slower operating speeds with resultant economies in fuel and engine wear.

Closer, continuous control of engine and compressor is also said to have been developed to the point where 100-lb minimum pressure is constantly maintained over the entire operating range. All speed modulation is smooth and stepless and control is instantaneous so as to positively prevent over-run and racing of the engine. Simplicity of control is also an advantage. There are no metering orifices, complex linkage or toggles. Starting and stopping require only the half-turn of a regulator crank.

Copper tube finned multi-pass oil cooler insures cool operation in ambient temperatures exceeding 100°. In cold weather starting, oil is automatically by-passed to the compressor cylinders to protect against dry starts.

Jaeger Machine Co.

■

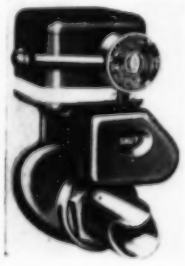


4 Hot Water Boiler

Ward Heater Co. is marketing a newly designed gas-fired hot water heating boiler for radiant, convector, baseboard and all closed systems. The unit is compact, light in weight, has a unique control assembly, is factory assembled, tested, and completely packaged.

Ward Heater Co.

5 Manual Reset Valves



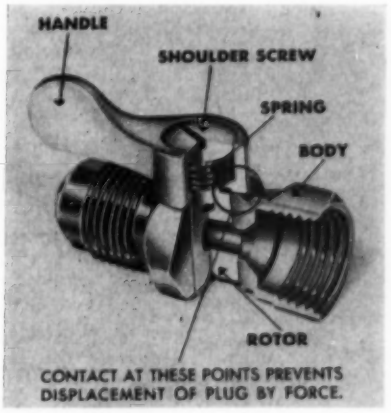
Fireye Series 81G manual reset valves are especially designed for use with Fireye flame failure safeguard systems for use in shutting off the flow of fuels in oil and gas burners in cases of faulty operation.

The positive, leakproof closing action of these valves provides maximum protection against burner explosion hazards. Their foolproof manual reset mechanism prevents re-opening unless the electric holding coil is energized. Full area port and straight-through body design offers higher capacities with lower pressure drops. Extra-power holding coils, glass insulated for longer life, are provided, together with a corrosion-proofed latching assembly.

The new Fireye valves are available in sizes from 1-in. to 4-in. for use with manufactured, natural or mixed, or L.P. gas.

Electronics Corp. of America

■



6 Gas Valve

The Deutsch Co. has developed a new gas valve that combines the safety features of fixed adjustment lock nut types with spring loaded plug types.

This new valve is basically a fixed adjustment type with a spring takeup to provide leak-proof service regardless of usage and wear.

Danger of the valve becoming unseated by axial load against the spring bearing end of the plug is also eliminated, it is claimed. The spring is contained within the head of the plug, making it impossible for the plug to become unseated. Sealing surfaces remain in contact at all times.

To assure maximum safety, only brass or steel bar stock is used for the body and brass for the plug. When steel is used for the body, it is protected against rust and corrosion by cadmium plating and is iridite, brass color, finished for pleasing appearance.

The Deutsch Co.

■

7 Gas Circulators

Three new innovations are featured in the new Quaker Blue Flame vented gas circulators now being marketed by the Quaker Manufacturing Co., heating division of the Florence Stove Co.

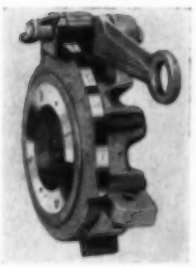
Warm floor comfort is assured with a new 'twin" floor level blower. Also

new is a series of small air-tight windows in the front of the combustion chamber permitting the user to see the flame at all times. New "air-stream" construction substantially increases warm air circulation. Cabinet and louvers are finished in baked-on hi-temp hammertone beige, expanded metal front and legs are in baked on "gold" silicone. Available in three capacities for all gases . . . 35,000, 50,000 and 65,000 Btu input. Each size is equipped with the new Minneapolis-Honeywell Adatrol 100% safety shutoff.

Quaker Manufacturing Co.

■

8 Die Head



Beaver Pipe Tools is marketing a new, improved Quadra-Type die head with die segments 1⅛ in. wide to assure a perfect, standard length thread. One set of dies threads all four sizes, 1-in. to 2-in.

The manufacturer claims that this new die head when set in position will hold thread graduation easily, accurately, and will not slip. It is fully adjustable to cut standard, and over or under standard threads. Die numbers are deeply and clearly marked by a special engraving process. Die set numbers are easily read, even through oil film or dim light.

Beaver Pipe Tool Inc.

■

9 A-C Welder

A new general purpose a-c welder, for job shops and light industrial applications, has been announced by the General Electric Co.'s welding department.

Covering a current range of 25 to 295 amp, the new welder is ideal for maintenance work, tack welding at high

currents, and steady welding at moderate currents. The welder provides a 50% duty cycle in the normal welding range of 200 amp, with somewhat lower duty cycles when higher settings are used.

A low range open circuit voltage of 75 volts provides easier starting and facilitates use of low hydrogen and stainless steel electrodes. Utilizing the moving primary coil design, the G-E welder provides pin-point accuracy of current settings and resettings.

To simplify routine maintenance and primary connections, side covers of the new welder may be removed by taking out three screws on each side. The welder also includes a dual position range switch, fingertip current adjustment, and bolt-type output terminals.

General Electric Co.

■

10 Packless Valve

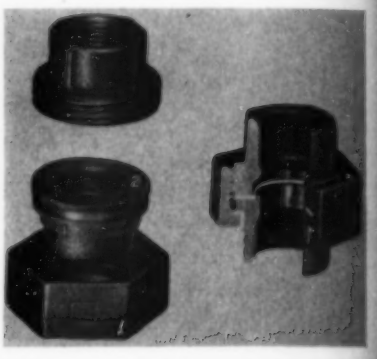
Automatic Switch Co.'s new direct-lift, solenoid-operated packless valve has been designed for low pressure application up to 7 psi and is available in ⅜- and ½-in. sizes.

The only moving element is a stainless steel core and composition disc, housed in a heavy forged brass body. Designed primarily as a gas pilot control valve on power boilers, the 8030A is suitable for low-pressure air and gas control on gas-fired ovens and furnaces, automatic dispensing units, vacuum-holding applications, and similar units.

The valve can be used to control gas, air, propane, butane, water, gas line, light fuel oil and other fluids to 180° F.

Automatic Switch Co.

■



11 Dielectric Union

Damage to gas and air lines caused by electrolytic corrosion can be stopped in most cases with a new dielectric union, a product of the Grabler Manufacturing Co. This union may be used to insulate one supply line pipe from another, thus preventing the passage of electric current, eliminating electrolytic corrosion due to stray currents, galvanic action and related electrical causes.

The Grabler dielectric union has a high insulating factor and is rated at a dielectric strength of 250 volts. It has been designed for 300 psi with cold water, or 150 psi with steam. The insulating action is provided by an insulating dielectric sleeve and a rubber gasket, which completely separates the "swivel" of the union from the body and the nut, preventing electrical contact. Sleeve and gasket are mechanically supported by malleable iron surfaces of the union parts, producing a strong and enduring seal.

The Grabler dielectric union is furnished with insulating parts in place.

Grabler Manufacturing Co.

meet George Briggmann*

. . . a member of CARBIDE's CARBOSEAL *Anti-Leak staff*—with a gas crew and a camera crew, shooting scenes for the movie "CARBOSEAL Anti-Leak Stops Gas-Main Leakage." In 15 minutes, this film shows you the ease, economy, and effectiveness of CARBOSEAL Anti-Leak in stopping leakage due to dried-out fiber packing.

There's a lot of George's valuable experience in this 16 mm. color-sound film. And we'll be glad to lend it to you—just write to:

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Model A
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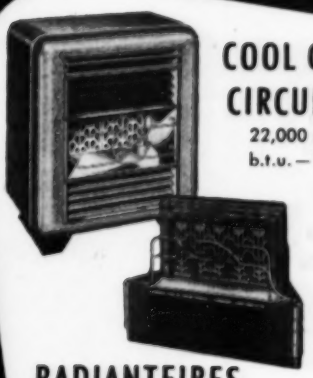
65,000 to 250,000 b.t.u.

Model 40-G
COMPACT UNIT HEATER
40,000 b.t.u. input



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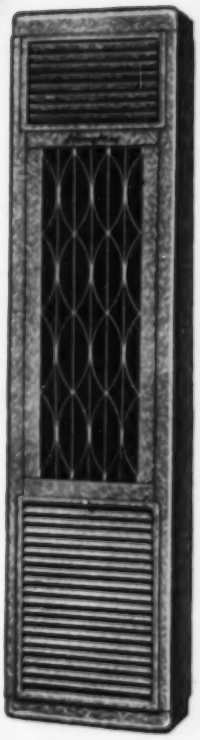
22,000 or 32,000 b.t.u. — 2 Finishes

RADIANTFIRES
Wide range of models in both vented and unvented styles.



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RADIANTFIRE CIRCULATORS
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2 Finishes

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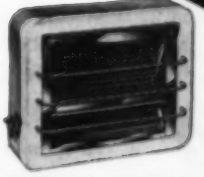


RAFIRE BATHROOM HEATERS

GENERAL GAS LIGHT CO.

Kalamazoo, Michigan

GAS trade literature

12 Record Catalogs

Two new catalogs are available from Diebold Inc. (When ordering copies, use letter preceding description together with number of head.)

a. Catalog AL-2817 is a 20-page, multi-colored and illustrated catalog describing use of Cardineer rotary card files.

b. Catalog AL-2804 is a two-color, four-page illustrated catalog that provides complete information on a new low-cost, space-saving method of storing inactive records in Safe-T-Stak steel storage files.

Diebold Inc.

■

13 Lube Manual

ACF Industries ACF Lube Manual No. 3 covers lubricants for ACF plug valves. The booklet, which is illustrated with cross sectional views of ACF valves, goes into considerable detail regarding their construction.

ACF Industries Inc.

BETTER
BEST
When it comes to the diaphragm data in your meter service records, you'll see better over-all accuracy and longer service life with Lancaster Groove Type Metal Rim Diaphragms in your meters.
From the groove type design which assures equal leather at both "in" and "out" stroke extremes . . . to the fine specially processed leather itself, Lancaster has the edge in practical engineering, quality materials and precision workmanship.
Send for a sample and see for yourself
METER PARTS CO.

14 Ditcher Catalogs

Two new catalogs are available from Gar Wood Industries. (When ordering, use letter preceding description together with number of head.)

a. Buckeye Model 403, a small compact ditcher, is described in an eight-page catalog, which contains action photos of the unit.

b. Buckeye Model 303 utility ditcher is described in another eight-page catalog. It contains detailed photos of some of the unit's outstanding design features.

Gar Wood Industries Inc.

■

15 Compressor Bulletin

Ingersoll-Rand's new 4-page, two-color bulletin describes its Model 20T compressor equipped with the I-R channel valve. The bulletin includes cutaway views and a table of specifications on the air-cooled 20-hp compressor, which may be either direct-connected or belt-driven.

Ingersoll-Rand

■

16 A.C. Motor Catalog

A new 28-page catalog of buying information on a-c motors is available from General Electric. Designated GEC-1026, the bulletin presents complete information on standard a-c fractional and integral horsepower motors in most general use.

General Electric Co.

■

17 Control Process Catalog

"Temperature Control Systems" is the title of a new Barber-Colman bulletin for those interested in the application of automatic control to industrial process applications. Wheelco Bulletin F 6149-2 contains a section on the selection of sensing elements, control terminology, and an explanation of various types of control systems.

Barber-Colman Co.

■

18 Water Heater Mailer

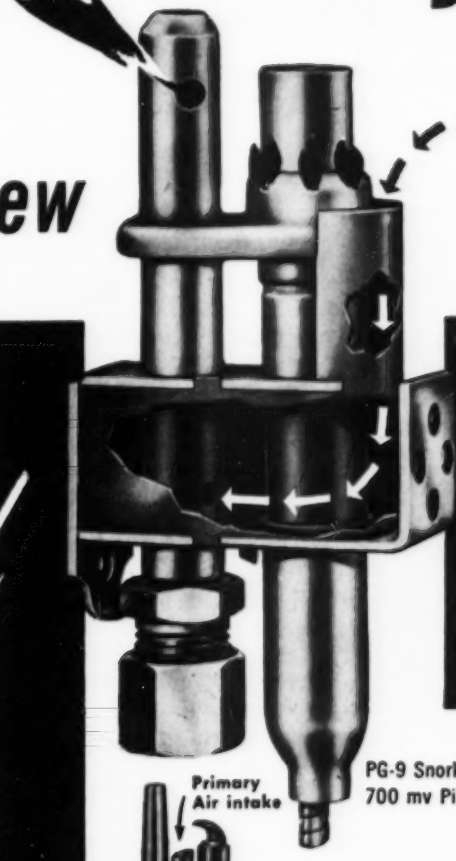
Ruud Manufacturing Co. has issued a self-mailer for use by utilities, LPG distributors, appliance dealers and plumbing contractors to acquaint their customers with the new Ruud Alcoa Alloy standard gas water heaters. The two-color folder presents an easy-to-read description of the water heater's features.

Ruud Manufacturing Co.

no linting no lazy flame

with the new

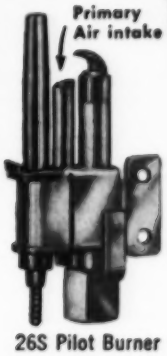
Snorkel type



PG-9 Snorkel
700 mv Pilot Generator

POSITIVE INCINERATOR PRINCIPLE . . .

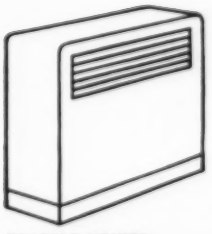
DIRT-FREE PRIMARY AIR THROUGH SNORKEL INSURES BLUE FLAME PILOT STABILITY ON ALL GAS-FIRED APPLIANCES



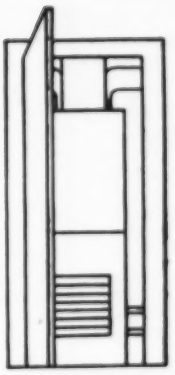
26S Pilot Burner

260S Pilot Burner

General Controls' Snorkel Pilot Burners and Pilot Generators incorporate proven design principle. The primary air passes under pilot flame which incinerates dirt and lint. Elimination of these foreign particles insures a crisp and stable blue flame. Primary air is mixed with gas at pilot orifice in a sealed mixing chamber which is cool, thus preventing cracking of the gas. Pilot and thermopilot flame ports are large diameter to prevent plugging. PG-9 Snorkel Pilot Generators, 260S and 26S Pilot Burners are available for all General Controls thermocouple-operated safety and self-powered control systems.



CONSOLE HEATER



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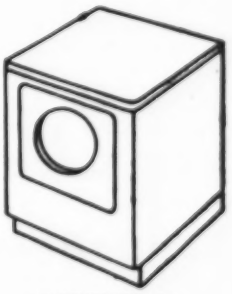
WALL HEATER



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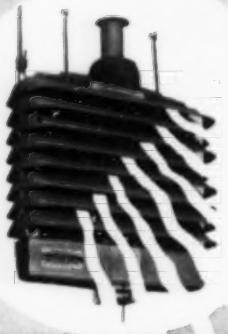

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silent and draft-free
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PANELBLOC
INFRA-RED UNIT HEATERS

- Comfortably heats workers and machines within radiation area.
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- No fan, motor or electrical connection needed.
- Never shut down due to power failure.
- Heat delivery cannot be diverted by drafts from open doors.
- No moving parts . . . less maintenance.
- May be used with any commercial type gas fuel.

Remember how comfortable it feels to stand in the warm sun on a cold day? That's how Panelblocs work. Gentle, comfortable heat rays warm everything they touch. You have all the advantages of conventional heaters . . . none of the disadvantages.

Panelbloc uses no fan. This means no drafts (heating is accomplished by guided radiation). With no electrical connections, Panelbloc costs less to install—will continue to operate during a power failure . . . and it heats, not air, but personnel and equipment . . . anything solid.

Panelbloc may be installed in practically any type structure for general heating; for spot heating in an otherwise unheated building; for heating a single room . . . In fact, almost any heating requirement can be solved with Panelbloc. Available in two models: 62,500 btu and 125,000 btu input.

For warm air heating check the Prat-Daniel THERMOBLOC Heater . . . used the world over.

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GAS news

Third-year natural gas sales in Pacific Northwest will nearly equal kilowatt production in terms of therms

As the story of natural gas for the Pacific Northwest continues to unfold and new elements and new plans are injected, the magnitude of the vast new market becomes increasily evident. The increase in proposed expenditures for transmission facilities from $160 million to $400 million, brought about by the joining of Westcoast Transmission Co.'s Canadian gas scheme to the overall plan for serving the area, has been paralleled by a corresponding jump in proposed expenditures by the distributing gas utilities in the area.

Just as an example, Portland Gas & Coke Co. was not even a party to the Pacific Northwest program as certified. But with Westcoast in the picture, Portland assumes the position of the potentially largest "spender" of the total utility group. Portland has $17 million budgeted for the three-to-five year task of converting and expanding.

Up-to-date forecast of natural gas consumption in the Pacific Northwest indicates that during the third year of operation of the Pacific Northwest Pipeline, natural gas sales, in terms of thermal energy, will be nearly equivalent to the total kilowatt hour production of both privately and publicly owned electric facilities in the area in 1953.

According to the Edison Electric Institute Statistical Bulletin, the states of Washington, Oregon and Idaho produced 33.5 billion kilowatt hours in 1953. Anticipated gas sales of 1,012,629,480 therms during the third year of natural gas operation converts to 29.7 billion kilowatt hours. Thus a region that is one of the world's foremost producers of hydroelectric power will have a new source of energy nearly equivalent to that supplied by all its great dams.

Within three years, Pacific Northwest gasmen expect gas consumption to increase 500 to 600% over the present 17 billion cu ft of manufactured gas used today. This increase, of course, anticipates heavy consumption by industries already established in the area, and new plants that will be attracted to the Northwest because of the availability of natural gas, as well as a greatly expanded domestic market.

The first of many economic benefits to be realized will be the new business activity generated by construction payrolls and material purchases by both transmission and distribution companies. More than $400 million will be spent to bring natural gas to the Pacific Northwest. This expenditure is for big-inch transmission lines being built into the area from both the San Juan basin in southern Colorado and northern New Mexico, and from the Peace river gas fields in Alberta, Canada, assuring the Pacific Northwest a firm and plentiful supply of natural gas.

Prior to completion of the transmission lines, distribution companies in the area will have begun extensive expansion programs, and will have completed conversion of most gas appliances in their service areas.

Portland Gas & Coke Co., largest distributor of gas in the Pacific Northwest,

ESTIMATED CONVERSION AND EXPANSION EXPENDITURES, AND ESTIMATED NEW GAS CUSTOMERS IN THE PACIFIC NORTHWEST

Pacific Northwest Gas Companies	Estimated Expenditures for Conversion and Expansion	Estimated Customers to Be Added Within Five Years
Portland Gas & Coke Co.	$17,000,000	50,000
California Pacific Utilities Co.	———	750
Seattle Gas Co.	13,500,000	35,000
Spokane Gas & Fuel Co.	5,000,000	8,650
Washington Gas & Electric Co.	6,000,000	10,000
Cascade Natural Gas Corp.	11,000,000	40,000
United Gas Co.	———	1,200
Twin Cities Gas Co.	———	1,200
British Columbia Electric	18,000,000	62,600
	$70,500,000	209,400

Customers to be added by Spokane Gas & Fuel Co., British Columbia Electric, and several of the smaller companies were estimated on the basis of returns from reporting companies.

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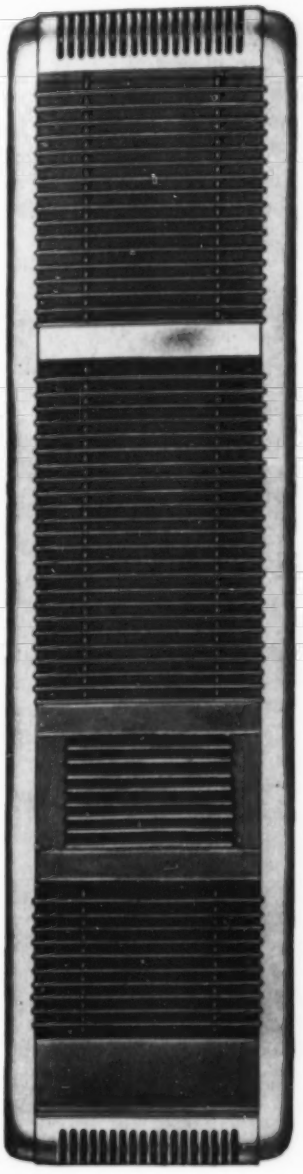
There's NO DOUBT *about it!*



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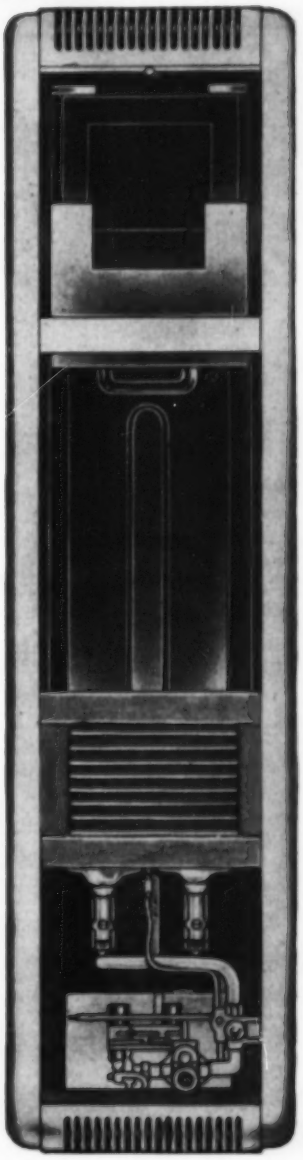
Sell them QUALITY THAT WILL GIVE SERVICE FOR YEARS—QUALITY THAT'S EXCLUSIVE.

Sell them SAFETY THAT'S BETTER THAN ANYTHING MADE.

Sell them QUALITY HEATING AND CONTROL UNITS—THE BEST THE MARKET AFFORDS.



EMPIRE'S famous Recessed Heater is your biggest winter profit-maker . . . No. 1 in sales all over America. And, comfort-makers can be your biggest profit-makers too. They're loaded with features and they're loaded with quality. They're highly competitive in price . . . high in performance . . . high in looks. And when you carry the EMPIRE line you carry EMPIRE'S reputation . . . there's no doubt about it

MINIMUM FIELD SERVICE REQUIRED · **DEALERS ACCEPTANCE** · **MOST EFFICIENT *Gas* BURNER MADE** · **USER SATISFACTION** · **SILENT IN OPERATION**

EMPIRE

A Great Name in Gas Appliances

STOVE COMPANY

BELLEVILLE, ILLINOIS

"Frankly, I'm worried about this election . . . but Throckmorton keeps insisting 'It's in the bag!' "

Throckmorton's method *is* one way of guaranteeing better results. But there are other applications of this "in the bag" technique which serve a far more useful purpose. Standard Magnesium, for example, puts its VIBRA-PAK ANODES "in the bag" . . . to insure proper centering of the anode in the chemicals regardless of shipping and handling.

VIBRA-PAK's new backfill packaging technique serves another purpose, also. Now you can *install* your anodes quicker . . . easier . . . more accurately.

Best of all, VIBRA-PAK packaging is only *one* of the many advantages offered by Standard Magnesium. There's also the high standard of purity . . . maintained by spectrographic analysis . . . which means more current per pound, longer life per anode. And, of course, the wonderful new, patented *spiral* core; the core that won't separate from the anode.

Next time get the anode which brings you higher efficiency, longer life, greater ease of handling. Specify Standard Magnesium VIBRA-PAK ANODES.

For further information please address all inquiries to P. O. Box 1424-G, Tulsa, Oklahoma.

Standard Magnesium Corporation
TULSA, OKLAHOMA

Pioneers of: SPECTROGRAPHICALLY ANALYZED ANODES AND CYLINDRICAL ANODES

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has announced it will spend approximately $3 million converting more than 500,000 gas appliances now on its lines.

Conversion & Surveys, a subsidiary of Stone Webster Service Corp. of New York, will do the conversion job, sending a crew of about 350 men into the service area. It will take approximately four mouths to complete the task of adjusting appliances from manufactured to natural gas. Portland officials said they expect sales to increase four or five times by 1960, and that the number of customers will increase from 82,000 to possibly 130,000.

Seattle Gas Co. estimates total expenditures of $15 million through the fifth year of conversion. This figure includes all supply mains, distribution mains, meters, service, district regulators, and measuring stations.

Three million dollars of this amount will be spent before July 1, 1956, which is the date scheduled for the arrival of natural gas.

According to company officials, Seattle Gas expects to add 35,000 new meters, and an additional 10,000 new heating customers to existing meters. This will bring the company's total heating customers to 54,000.

Cascade Natural Gas Corp., serving 19 communities in Washington and Oregon, expects that its markets will consume 17% of the expected amount of natural gas to be brought into the Pacific Northwest.

Stewart Matthews, president of Cascade, said, "Today Cascade serves approximately 11,000 customers, but it is anticipated that within the next five years, in excess of 40,000 additional customers will be added to the system."

Expansion and conversion is expected to cost Cascade $11 million.

Washington Gas and Electric Co., serving 10 cities, all in Washington, contemplates spending $6 million for new construction, with conversion costs estimated at $260,000. Within five years, the company expects to add 10,000 customers.

Allen Peyser, president of Washington Gas and Electric, said he anticipates additional appliance sales of $4 million in the markets served by his company.

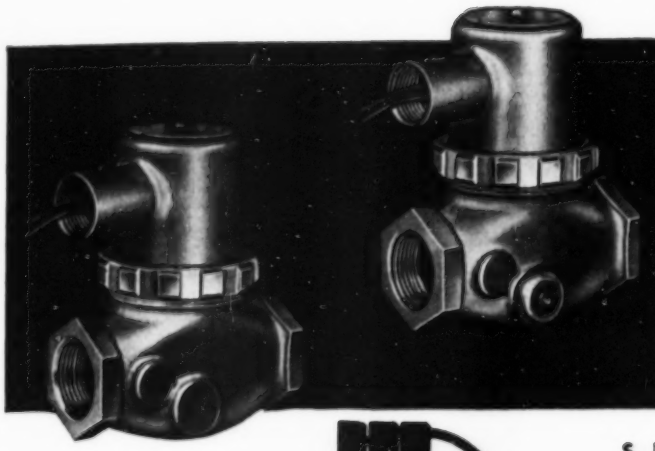
British Columbia Electric, Vancouver, B.C., will spend an estimated $18 million on conversion, expansion, and installation of new distribution mains in a number of cities and communities served by that company.

Spokane Gas & Fuel will spend an estimated $5 million for extending service throughout Spokane and the Spokane valley.

Additional conversion and expansion is being planned by United Gas Co., serving Camas and Washougal, Wash.;

White-Rodgers "CUSHIONED POWER" ...the Only Solenoid Gas Valves that **MEET ALL S.U.R. STANDARDS**

...and the **MOST QUIET** *ever made!*



HEAR and see this convincing display at your Heating Wholesaler... positive proof of the unusually quiet operation of "Cushioned Power" Valves.

Available with or without manual operator. ... Also with plug-in automatic pilot.

S. U. R. (Supplementary Utility Requirements) are over and above standard A.G.A. requirements and are followed by a large group of eastern utilities.

WHITE-RODGERS *Controls* FOR HEATING · REFRIGERATION AND AIR CONDITIONING

ST. LOUIS 6, MO.
TORONTO 8, ONTARIO

No matter how well built the heating plant you install... if its performance depends on automatic controls... it can be no better than the controls with which it is equipped.

California-Pacific Utilities Co. serving LaGrande, Ore.; and Twin Cities Gas Co., serving Longview and Kelso, Wash.

Natural gas from two of the largest gas fields in the world will be piped to the Pacific Northwest, bringing immediate benefits to the region in terms of new business, new payrolls, and new conveniences to the hundreds of residents who will receive service.

The enthusiasm of distribution companies is shared by appliance manufacturers who anticipate a tremendous increase in both the industrial and domestic use of natural gas.

Several firms have already announced plans for expansion in the Pacific Northwest.

Rheem Manufacturing Co. has purchased the Seidelhuber Iron Works in Portland, for water heater production and is planning expansion of the Rheem-Wedgewood sales organization in anticipation of a substantial market for Wedgewood gas ranges and Rheem clothes driers.

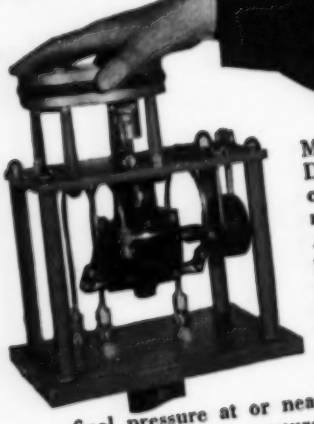
Continental Water Heater Co., in conjunction with its parent organization, National Steel Construction Co., is planning to go into production of water heaters in Seattle, according to Continental president, W. R. Smith Sr.

O'Keefe & Merritt has disclosed affiliation with E. H. McCaffery of Vancouver, B.C., one of the largest merchandisers in the Northwest. Gordon Boyle, O'Keefe & Merritt sales manager, said this was a move to prepare the company for service to Northwest consumers.

Increased sales personnel was disclosed by Fowler Manufacturing Co., Portland, with an eye toward plant expansion if necessary. A company spokesman said the firm anticipates considerable increase in the use and sale of gas water heaters in the Northwest with the coming of natural gas.

ARCCO

ARCCO-Anubis CONTINUOUS GAS SAMPLER



MEETING THE DEMAND for more accurate gas sampling, this newly perfected ARCCO-Anubis instrument replaces inadequate, inaccurate spot sampling methods. The Model 100-7 will over a period of seven days accumulate at a constant rate a sample of gas to a final pressure at or near 100 psig from a sample source, the minimum pressure of which is not less than 125 psig.

The ARCCO-Anubis design is based on the principle that maintenance of a constant rate of increase in gas pressure within a closed container, from zero to any selected maximum pressure, will result in a continuous rate of flow of gas into the closed container.

This is accomplished by means of a specially designed regulation system equipped with a precision drive mechanism so as to obtain a constant predetermined rate of increase in the outlet pressure into the sample container.

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SEND FOR BULLETIN No. 112

Seattle Gas Co. awards home economics scholarship

Scholarship in the field of home economics was given attention considered long overdue when Charles M. Sturkey, executive vice president and general manager of Seattle (Wash.) Gas Co., awarded the company's first annual home economics scholarship to Nancy Lang, 19, graduating senior of West Seattle high school.

The annual award, to be known as the June Holladay scholarship, provides a cash grant on a three-year annual award basis, and is the first to be offered in the field by a business firm to graduates of Seattle high schools.

The scholarship is available to Miss Lang for majoring in home economics at any Northwest college or university. Winner of the annual grant will also have the option of earning money toward her fourth year by working in the home service department of Seattle Gas during the summer between her third and fourth year.

Welbilt, Detroit-Michigan merger approved

Merger of Detroit-Michigan Stove Co. and Welbilt Stove Co., Maspeth, N. Y. was approved by stockholders of both companies at a recent meeting. Under the agreement, which became effective immediately following the stockholder action, Welbilt was merged into Detroit-Michigan and the name of the latter was changed to Welbilt Corp., the surviving company.

Alexander P. Hirsch, formerly president and a director of Welbilt Stove, is chairman of the board of the new company; Henry Hirsch, formerly vice president, treasurer, and director of Welbilt, is president and director of the new company. Fred A. Kaiser, who was president and a director of Detroit-Michigan, has been named manager of the Detroit division of the new firm.

Profit by professional sales training!

"Mr. B" goes to school—and profits. **BRYANT** offers organized field and factory schools for dealers—with full-time, professional instructors in sales and service.

be "Mr. B"

(AUTHORIZED BRYANT HOME COMFORT DEALER)

Only "Mr. B"—the Bryant Home Comfort Dealer—has *all 8* of these selling assets to build his business BIG:

1. A name customers know and want
2. The most complete line of automatic heating, air conditioning, water heating
3. Quality equipment for every market
4. Exceptional distributor service
5. Professional sales training
6. Personalized selling tools for you
7. National advertising featuring you
8. Co-op "Mr. B" ads for local papers

For bigger profits now, for a secure and prosperous future—see your Bryant Distributor. Ask him about Bryant's big "Mr. B" action program, and how it can make sales and money for you!

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AUTOMATIC HEATING
AIR CONDITIONING
WATER HEATING

"Our Sherman Power Diggers Are Easy to Handle and Maneuver in Tight Places"

One of the two Sherman Power Diggers owned by I. & M. Contracting Co., Bronx, New York, is shown on a trenching job for a public utility company in Long Island City.

Mr. Elio Mazella, co-owner of the contracting firm states: "Sherman Power Diggers are exceptionally good. They are easy to handle and maneuver in tight places. In comparison with former excavating methods, these diggers save us at least 70 per cent."

Sherman's speed, maneuverability and easy operation appeal to custom operators, contractors, utility companies, municipalities . . . everyone who wants the savings of mechanized excavating. Even on the smallest jobs the Sherman is practical, since it releases heavier equipment for bigger jobs . . . yet it digs in a fraction of the time and cost of manual labor.

Use the Sherman Power Digger as deep as 10 feet below ground . . . in mud, hardpan, shale, oiled roads, blacktop and stony ground. Initial cost is surprisingly low, and maintenance is simple and inexpensive. Ask your Ford Tractor dealer for an on-the-job demonstration, or write today for Bulletin No. 418.

*Designed, Engineered and Manufactured Jointly by Sherman Products, Inc., Royal Oak, Michigan. Wain-Roy Corporation, Hubbardston, Mass.

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Patent No. 2-303-852
Other Patents Pending

•

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PRODUCTS, INC.
ROYAL OAK, MICHIGAN
POWER DIGGERS* • FRONT END LOADERS • FORK LIFTS

New York rate theory threatened by court action

Although New York laws covering gas and electric utility and railroad rate fixing say that rates "should be fixed, with due regard, among other things, to a reasonable average return upon capital actually expended," this rate base theory is being threatened by a recent action of the appellate division of the New York supreme court.

In a lengthy divided opinion, the court held that the New York PSC was in error when it refused to accept and consider evidence of current value with respect to the New York Telephone Co. properties. (A section of the Public Service Law directs the PSC to regulate telephone rates "with due regard, among other things, to a reasonable average return upon the value of property actually used in the public service.)

Thus, New York becomes the sixth and largest state in which court decisions within the last few years have reversed state commission rulings adhering to a strict cost basis.

In some quarters it is believed that if the appellate decision is upheld there would still be uncertainty as to whether the commission might continue to use cost rate base for gas and electric utility and carriers.

1970 water heater sales at 3.7 million predicted

If the gas appliance manufacturers of the nation plan properly to serve the mushrooming market, there is no reason why average annual sales of domestic gas water heaters should not reach nearly 3.7 million units by 1970 F. S. Cornell, vice president and general manager of the A. O. Smith Corp., said recently.

Mr. Cornell, whose company manufactures the Permaglas line of glass-lined water heaters, pointed out that the automatic gas water heater took nearly 18 years to achieve any real acceptance, attained annual volume of an average 426,000 between 1936-1940. Then pent-up demand of World War II years burst forth in the 1946-1950 period when annual volume jumped to 1,689,000—a four time expansion.

Outlining the factors behind his expectations of a 1970 sales goal, Mr. Cornell said, "Since 1950 we have averaged over 2 million units per year. We see increasing demands—not any letup—if we do our planning properly.

"Predicated upon factors of population, household formations and the annual birth of more than 4 million babies in this country, all yelling for hot water, we can confidently see ahead for

AN OLD FAVORITE
WITH
SMART NEW STYLING

- 100% automatic shut-off
- AGA listed for all fuel gases
- Power unit and main valve easily removed in the field for servicing
- The most positive, efficient mechanism in use today
- All parts case-hardened, cadmium-plated steel for lifetime service—no plastics
- Styled to enhance beauty of any water heater
- Generously engineered to meet severe operating conditions
- Unconditionally guaranteed

All the proved high-performance features of the Titan Tankmaster have been built into the beautifully-styled new Tankmaster Model C-100. It is a water heater control that will live up to every requirement put upon it. Completely safe. Exclusive pushbutton pilot eliminates lighting hazard. In fact this valve cannot operate unsafely! Positive acting snap action valve. Quickly, easily installed. All parts more readily accessible for cleaning than any other valve.

Specify Tankmaster next time. Its performance will justify your complete confidence. Furthermore Tankmaster is backed by

THE TITAN VALVE & MANUFACTURING CO.
9313 ELK AVENUE CLEVELAND 8, OHIO

Write for complete specifications including dimensional data and installation instructions. Or ask for Catalog 54 which illustrates the complete line of Titan thermostats and valves.

1970 an average annual volume of at least 3,682,000 units—more than double the 1946-1950 rate.

"By 1970, there should be 28.9 million water heaters in use in households, and the replacement factor alone, predicated on quality water heaters lasting 10 years, should account for 2,890,000 units. This is about 606,000 more units a year than we now sell as an industry for both new and replacement uses."

A three-pronged program of upgrading the industry—resting essentially in the hands of gas executives—must be carried out if these handsome goals are to be achieved, Mr. Cornell advised.

These are: (1) improving product constantly; (2) selling the value of the product and the service, and (3) expanding service to the maximum number of customers.

Product is being improved steadily, the speaker said. Greater deliverability of hot water is being provided, in line with the increasing hot water needs of the growing American families and the many new water using appliances in the modern home. More attention is being devoted to uniformly maintained temperatures in water heaters.

"Eventually temperature and pressure control should be an integral part of the water heater—not a disconnected accessory," Mr. Cornell stated.

He termed "ridiculous" the shortsighted practice of many large manufacturers, utilities and distributors today of selling only on price. He added:

"Each manufacturer is the best judge of the worth of his own product. And when the water heater business reaches its crest, the relatively few manufacturers who survive will be determined by those who sell on value received, not initial price. Poor quality lives to haunt you long after the low price is forgotten."

Mr. Cornell, in his third admonition, urged gas executives to combine their efforts to bring natural gas service to the maximum number of users as quickly as possible. He said that only by extending service to the greatest number can the required market coverage be obtained by appliance people.

Quebec Hydro-Electric's gas facilities to be sold

Quebec Hydro-Electric Co.'s gas manufacturing and sales division will be sold for $30 million to a company formed by principals of Trans-Canada Pipe Lines Ltd.

The purchase will be financed by a $20 million Bank of Canada loan, according to Trans-Canada's vice president, Frank Schultz, and by sale of debentures and common stock. An $18 million expansion program is planned in Montreal, converting the distributing facilities to natural gas.

Incinerator requirements become effective Jan. 1

The new American Standard Approval Requirements for domestic gas-fired incinerators, which become effective Jan. 1, 1956, represent minimum standards for performance, safe operation and substantial and durable construction. The various provisions and tests prescribed are based on years of experience in the utilization of gas, and the results of extensive research. They are designed to assure the safe and efficient performance and substantial and durable construction of equipment.

Nothing in these requirements is to be considered as in any way indicating a measure of quality beyond compliance with the provisions they contain. They are designed to allow compliance of domestic gas-fired incinerators, the construction and performance of which may exceed the various provisions specified in any respect. In their preparation full recognition has been given to possibilities of improvement through

"...no needle nervousness...pinpoint accuracy.

THE NEW AQUA VALVE BOX LOCATOR

has our unqualified approval!"

W. F. Becker, Chief Inspector
The Ohio Fuel Gas Company
Columbus, Ohio

Quicker, Surer Locations Every Time

The miraculous new Aqua Valve Box Locator makes obsolete all previous types. New design, perfected after two years of engineering research means **absolute minimum of needle spinning action.**

The new Aqua Extra Conductor development makes failure practically impossible, and it is **exclusive in the location instrument field!**

- New exclusive "Electric Braking" action
- Top-view reading. No stooping.
- Factory adjusted to your geographical location
- New high impact Styron plastic case virtually indestructible
- Compact, convenient, non-variable
- Guaranteed to function regardless of ground cover

$29.50
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Your Name in Gold Free

No Stooping!

Our Canadian Distributors:
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FRANCIS HAWKIN CO., LTD.
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FREE 15 DAY TRIAL

No Money! No Obligation! You be the judge.

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Gentlemen: Please send me
☐ New Aqua Valve Box Locator for FREE 15 day professional trial, without obligation.
☐ Detailed literature on new Aqua Valve Box Locator.

NAME.....
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STREET.....
CITY.....ZONE.....STATE.....

Build Summer Load!

Push Servel "add-on" gas-fired cooling units!

Right now! Right in your own back yard there's a happy solution to summer's low-load problems.

That's right! Your present space-heating customers are made-to-order prospects for Servel "add-on" cooling units.

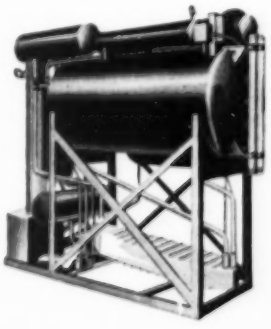
Your customers benefit with Servel! They live and work in cool, cool comfort during summer dog days.

You benefit with Servel, too! With these units on your lines, sendout tends to equalize throughout the year. And your profits go up, without increasing your winter peak, or capital investment.

Cash in on the giant demand for cool, comfortable summer living. Push the sale of Servel "add-on" cooling units in your area. For sure-fire promotion plans, write Servel, Inc., Air-Conditioning Division, Dept. G-75, Evansville 20, Indiana.

Servel Water Chillers cool plants, institutions, offices and stores; boost summer gas sales!

Industrial and commercial installations give you huge increases in summer gas use. Help provide steady load at profitable rates.



Servel All-Year® air conditioners are year-round customers!

Yes, owners of 2-, 3-, or 5-ton models are steady year-round customers. Like Servel "add-on" owners, they help build your summer load.

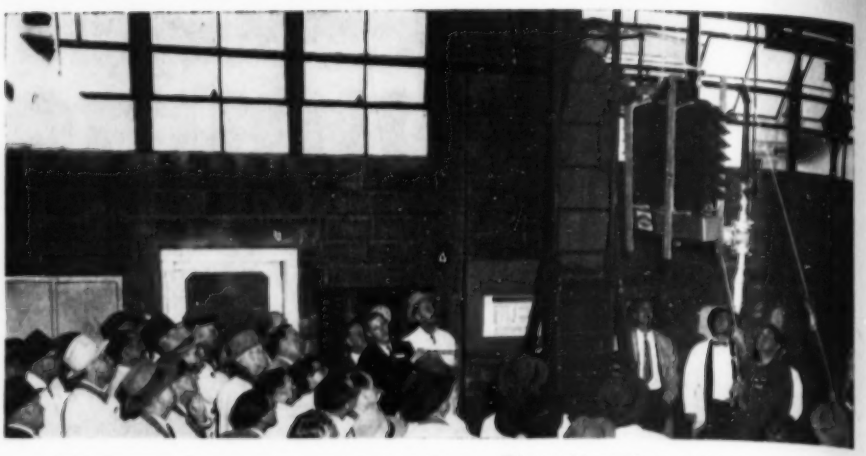
Servel

the name to watch for great advances in

AIR CONDITIONING ✓ REFRIGERATION

ingenuity of design. As progress takes place, revisions may become necessary. When they are believed desirable, recommendations should be forwarded to the chairman of the ASA sectional committee, Project Z21, AGA approval requirements committee, 420 Lexington Ave., New York 17.

Safe and satisfactory operation of a domestic gas-fired incinerator depends to great extent upon its proper installation. To assure satisfactory performance, appliances complying with these requirements should be installed in accordance with rules and regulations included in American Standard Installation of Gas Piping and Gas Appliances in Buildings, Z21.30-1954, manufacturers' installation instructions, and local municipal building codes.



Thermobloc sales engineers watch installation demonstration of overhead Panelbloc. The Panelbloc was removed from crate, hoisted to position, connected and put in operation. Prat-Daniel Corp.'s W. H. Engels gave the commentary on various steps involved. The installation was a feature of Thermobloc's annual sales meeting held at South Norwalk, Conn., recently.

These new requirements provide a more clear definition of capacity; specity fixed orifices for use with all gases; contain provisions designed to generally improve performance and minimize field servicing; change Incineration Efficiency to Incineration Ability, and define in detail the loading (in terms of quantity and type of material to be consumed in a given time to be used during the "ability" tests; and add smoke elimination characteristics in terms of the Ringleman criteria for density of emitted smoke.

Washington companies agree to merge

Directors of both Seattle (Wash.) Gas Co. and Washington Gas & Electric Co. have unanimously signed an agreement to merge the two companies. The merger also requires the approval of the Washington PSC.

In their statement, Walter S. Byrne, Seattle president, and Allen Peyser, president of Washington Gas, pointed out that the proposed merger has been given a detailed and impartial study by Stone & Webster Service Corp., which found the move "distinctly encouraging."

"The advent of natural gas will provide new opportunities for industrial and commercial expansion in western Washington. To take advantage of these opportunities, and to better serve the

here's the new larger

THERMAC

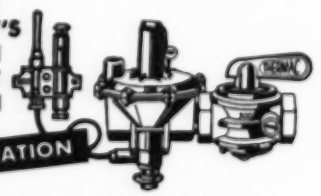
COMBINATION PRESSURE REGULATOR AND THERMO-ELECTRIC SAFETY PILOT

Certified by A.G.A.

Looking for a sure way to simplify your manifolds, improve operation of automatic appliances and reduce cost? The new Thermac SR-200 Combination Pressure Regulator and Thermo-Electric Safety Pilot offers you this opportunity on forced air furnaces, unit heaters, conversion burners, gravity furnaces, etc., ranging up to 226,200 B.T.U. Use of the new Thermac SR-200 effects an appreciable saving not only in piping and installation cost but also by elimination of an electric relay or separate automatic pilot unit. For ease of operation, a manual reset pull ring is provided at bottom of control.

Get sample and drawings of the SR-200 today. Test and compare it in any way. You'll find it well engineered to your program.

BEAT TODAY'S HIGH COST WITH THIS COMBINATION



Order the assembly of Thermac Regulator and Aluminum Alloy Shut-off Valve to your specifications.

THERMAC HM COMPANY

800 EAST 108TH STREET • LOS ANGELES 59, CALIFORNIA

"Over 20 years' experience in building gas controls"

people of the region, the stronger company will be able to secure financing at more advantageous terms," the presidents said.

Also, through the elimination of duplication in many operations, it will be possible to effect substantial economies, they believe.

Refrigerator campaign launched by Lone Star

Lone Star Gas Co., Dallas, is using the months of June and July for a big push on Servel gas refrigerators. The promotional program for the two-month campaign will be concentrated on the Ice-Maker.

Plans provide a $1 down payment with 36 months to pay. During the campaign a $100 trade-in allowance is being offered on any gas or electric refrigerator turned in on an Ice-Maker.

Advertising schedules include publication of a series of nine weekly ads in 242 system newspapers during the two-month campaign. Special handbooks were prepared by the advertising department for distribution to employees. The booklet contains information and pictures on all Servel models. Display material has been distributed to all company offices and dealers' stores, including those in Oklahoma.

Television coverage will include special announcements on the national Dionne Lucas show and a Dallas program. During the nine weeks of the campaign, spot announcements will be used on the radio.

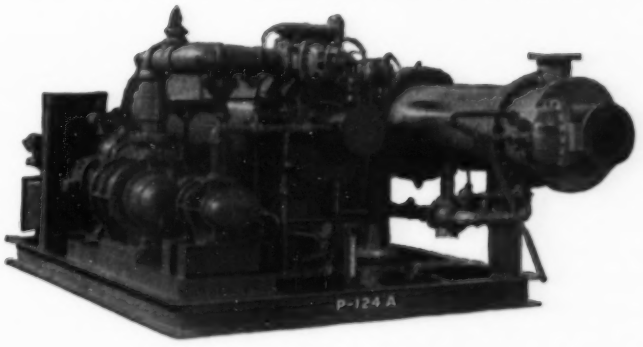
Lennox president predicts revolutionary developments

Revolutionary new developments in the field of warm air heating and air conditioning with gas were discussed by John Norris, president of Lennox Furnace Co., at the recent dedication of the company's new Pacific division headquarters. Mr. Norris, who travelled from Marshalltown, Iowa, home office of Lennox, for the dedication, predicted, that within a few years a gas heating-air conditioning unit operating at one-half the cost of electric units would be available to low income families.

Lennox looks forward to a large volume of sales in the California area. When natural gas reaches Oregon and Washington, the company plans to enlarge its distribution facilities in those states by building large warehouses there similar to the one put into operation in Los Angeles. President Norris is a strong believer in the benefits from modern, neat facilities.

The upper unit illustrated is a portable R-C Inert Gas Generator, oil-fired, with capacity of 35,000 cfh. The lower unit is a stationary type, gas-fired, with capacity of 50,000 cfh.

PROTECTION
at your finger tips
with
R-C INERT GAS GENERATORS



CHECK THE R-C
"BIG 4"
ESSENTIALS

1. **Compact units, portable or stationary**
2. **Choice of gas or liquid fuels**
3. **Low cost per cubic foot of capacity**
4. **Little supervision or maintenance**

You can find this combination of values only in R-C Inert Gas Generators.

Quick availability of smothering inert gas to reduce fire or explosion hazards not only protects against accident or property damage, but frequently results in lower insurance costs which often repay the cost of the equipment.

With R-C Inert Gas Generators, you can get fast action from either stationary or portable units. They can operate on either gas or liquid fuel, and their simple design permits instant readiness with little attention.

ASK FOR DETAILS

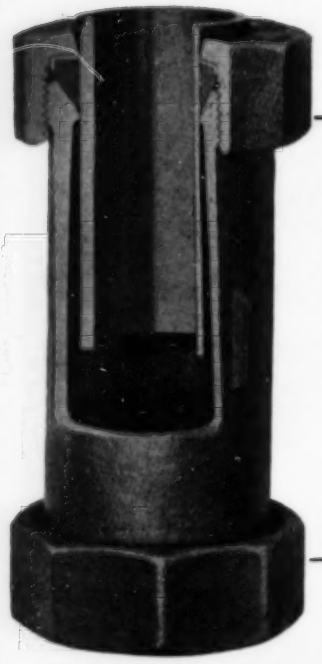
Ask the R-C engineer to point out where Inert Gas Generators can be used to advantage in your plant. Or, write for Bulletin 100-B-14.

ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.
755 Oregon Ave. • Connersville, Indiana

Roots-Connersville Blower (Canada) Ltd. • 629 Adelaide St. W., Toronto, Ont.

Centrifugal and Rotary Positive Blowers and Exhausters • Positive Displacement Meters • Vacuum Pumps • Gas Pumps • Inert Gas Generators • Spiroaxial Compressors



NORMAC

Couplings, Sleeves and Fittings

for maximum deflection, ease of "stabbing," complete confinement of the rubber!

So close are "Normac" rubbers confined at the gasket tip that possibility of flow is reduced almost to "nil." These couplings, sleeves and fittings . . . approved by gas utility men across the country for their time-saving features, ease of handling and dependable service . . . are available in a complete range of sizes. Made from air furnace malleable iron they provide greater wall thickness than pipe on which used.

NORMAC COUPLINGS are made with 5" centers in all sizes. NORMAC SLEEVES are identical in design except that they are made with 10" centers. Nuts and gaskets are interchangeable.

Compression-End Service "Tee"—First fitting of this type ever produced with full coupling depth and special threads on male end to prevent dropping into old hand taps when used to replace standard threaded fittings.

Compression-End Service "Ell" — Extra depth makes it possible to "stab" pipe into stops and without measuring, pull back a safe distance to allow ultimate deflection eliminating possibility of strain against tap in main.

Compression-End Iron Body Brass Core Service Stopcocks—End the necessity of threading on the job plus the elimination of the threads themselves—combining all the advantages of NORMAC COUPLINGS and the best in stopcock design. 2½" coupling depth on each end.

Normac Brass Fittings Developed in 1939 for Use with Copper Tubing—Our complete line of brass fittings can be used either on new installations or where copper is run through old steel pipe in large or small openings. The center to end dimensions of NORMAC TEES correspond with old malleable iron fittings. This feature is extremely important in the use of these fittings in one foot openings where the tubing must line up with the steel which has been removed.

Write for the NORMAC CATALOG of Gas Distribution Equipment

NORTON-McMURRAY MFG. CO.

122 SOUTH MICHIGAN AVENUE - - - CHICAGO 3, ILLINOIS

Couplings • Meter Bars • Sleeves • Cocks • Bell Joint Clamps • Service Tees & Ells

GAS news notes

Auburn, Ind. was the scene of a celebration recently when civic leaders gathered to witness the turning on of natural gas into the distribution system of the Northern Indiana Fuel & Light Co. The company, which headquarters in Auburn, serves that city as well as Garrett, Avilla, and Kendallville with gas from the lines of Panhandle Eastern Pipe Line Co.

General Electric Co.'s welding department has established new direct sales offices and warehouses in St. Louis and Chicago. New organization set up for the department's central district includes appointments of Wendell E. Matchett as central district manager and acting supervisor of Chicago direct sales; Vernon H. Hartley as manager of St. Louis direct sales; and H. Nelson Simon as sales engineer in Detroit.

New Britain (Conn.) Gas Light Co. this year is marking 100 years of service. In 1855 a group of the town's leading citizens was granted authority to incorporate the New Britain Gas Light Co. In 1857 the company had 84 customers—today the locally owned and managed company serves more than 20,000 customers. Its system of mains has a total length of 151½ miles and its present plants cover approximately six acres.

Pennsylvania State University has changed the closing date for its Gulf Research & Development Co. fellowship in petroleum and natural gas engineering from May 1 to Aug. 15. Further information is available from J. C. Calhoun, College of Mineral Industries, University Park, Pa.

Eastern States Supply Corp., gas equipment distributor, has just moved its offices from 45-30 37th St., Long Island City, to 11 W. 42nd St., New York.

Although the Institute of Gas Technology restricts its undergraduate and graduate classes to males, Mrs. Ida Belle Spinks, United Gas Corp., Houston, can now boast of taking an IGT course of study. The only woman among 1081 enrollees to date in the institute's home study course "Natural Gas Production and Transmission," she has received the Certificate of Accomplishment awarded to all who satisfactorily complete the course.

Brooklyn (N. Y.) Union Gas Co. has awarded Meter Reader Thomas Bigelow $35 for his suggestion that the date on which a meter is to be read be

New Improved DEW POINT TESTER

from Refinery Supply Co.

- 0 TO 200 PSI FOR PROPANE VAPORS
- 0 to 1,000 PSI FOR NATURAL GAS

- Gauge window area now 4-times larger
- "O" Ring seals eliminate metal to metal joints to avoid leakage
- "O" Ring seals make windows and mirror easy to remove for cleaning
- Finger tightening nuts is all that is necessary to hold pressure.

- **PRECISION DETERMINATIONS:** Bureau of Mines tests show that with manipulations dew points can be duplicated to within 0.2°F.
- **ACCURACY:** Averaging test measurements, the Bureau of Mines reported less than 0.2°F. Dew point temperature difference compared to known standards.
- **SAFETY:** Hydrostatic tests show a maximum working pressure of 1,000 psi. Adjustable mirror allows for safe visual observation into the pressure body.

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The most complete line of scientific instruments and laboratory supplies in the world.

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SINCLAIR BUTANE PROPANE

Reliable Supply...where and when you need it!

Sinclair's vast production facilities, including natural gasoline plants, refineries, storage plants, tank cars and trucks are your assurance of a dependable supply of Sinclair LP Gas at all times...even in peak demand periods. Moreover, you can be sure of a trouble-free operation when you have uniform high quality and high heating value Sinclair LP Gas in your Butane and Propane installations.

Trained and experienced Sinclair engineers, men who are familiar with *your* problems, stand ready to serve you. Contact Sinclair today.

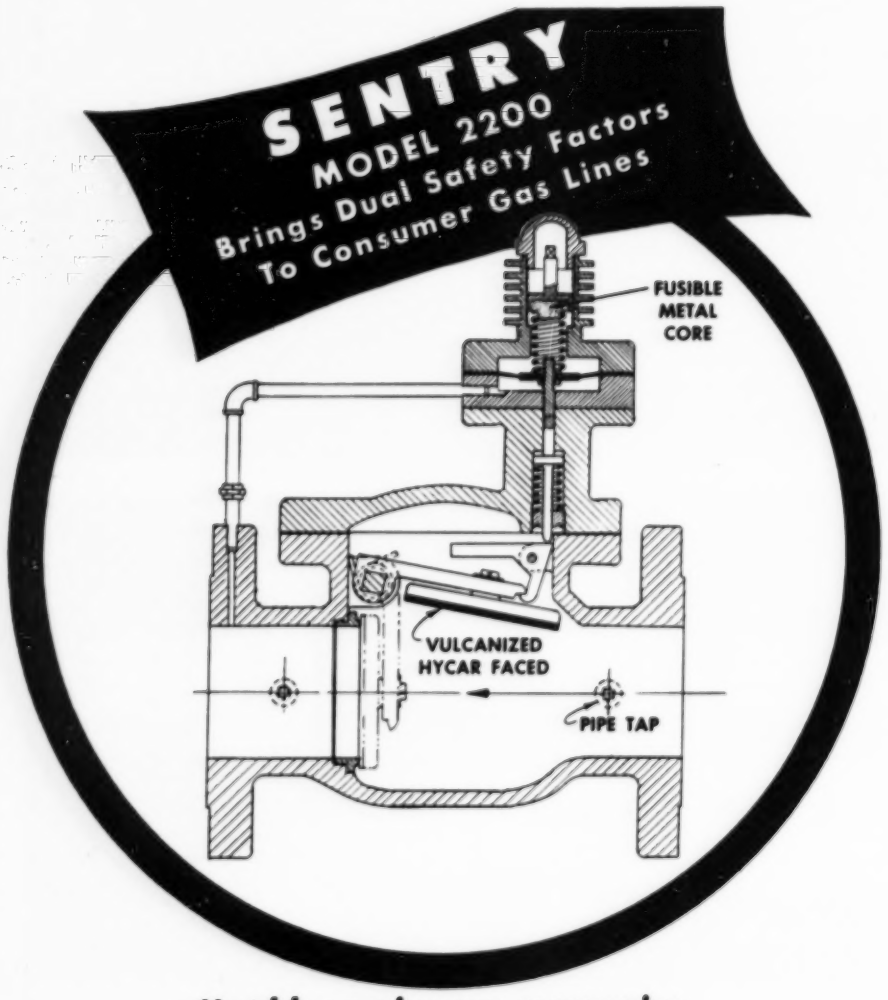
SINCLAIR
A Great Name in Oil

Sinclair Oil and Gas Company
Liquified Gas Sales Department
Sinclair Oil Building, Tulsa, Oklahoma

printed on the gas bill. Although the suggestion committee told him that the idea was not new, it was instrumental in developing further study on the project.

Two versions of the new consumer booklet produced by the National Council for LP-Gas Promotion, "L.P. Gas . . . Modern Fuel for Millions," are offered to industry companies for imprinting and local distribution. One contains hard-hitting promotional copy on all major uses of LPG, both home and farm, and a page which stresses the importance of adequate storage facilities on consumer premises. The other, a 16-page adaptation, which de-emphasizes heating and farm applications, is designed for bottled gas operators.

Southern Counties Gas Co., Los Angeles, has published a press relations book to assist division and staff personnel of the company in their contacts with the press. The booklet tells what is news and how to get it to the public through the news columns of the local newspapers.



Used by major gas companies

Automatically closes on predetermined dangerous high pressures.

Automatically closes, in case of fire in the area. Temperature closure may be specified.

Makes positive line seal when closed even if control is destroyed by fire or other causes.

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Offices: **750 North Glendale Avenue, Glendale, California**
Plant: **4617 Sperry Street, Los Angeles, California**

GAS calendar

July

18..Southeastern Gas Association Short Course in Gas Technology (ending Aug. 13)—Raleigh, N. C.

August

15..Southeastern Gas Association Short Course in Gas Technology (ending Sept. 10)—Raleigh, N. C.

29-31..15th Annual Appalachian Gas Measurement Short Course—West Virginia University, Morgantown, W. Va.

September

7-9..Mid-West Gas Association Gas School & Conference—Iowa State College, Ames.

9..New Jersey Gas Association—Hotel Monmouth, Spring Lake, N. J.

11-13..INGAA Annual Meeting—Jasper Lodge, Alberta.

14-15..AGA Accident Prevention Conference—Marion Hotel, Little Rock.

23..Oklahoma Utilities Association Gas Division—Oklahoma City.

16-17..Maryland Utilities Association Fall Conference—Virginia Beach, Va.

25-30..International Gas Union 6th Conference—Hotel New Yorker, New York.

October

12-14..Wisconsin Utilities Association Electric & Gas Section—Schroeder Hotel, Milwaukee.

12-14..GAMA Annual Meeting—El Mirador Hotel, Palm Springs, Calif.

17-19..1955 AGA and PCGA Convention—Los Angeles.

24-27..National Association of Railroad & Utilities Commissioners—Asheville, N. C.

November

13-18..American Society of Mechanical Engineers—Congress & Hilton Hotels, Chicago.

14-17..American Petroleum Institute—San Francisco.

16-18..Southeastern Gas Association—Roanoke Hotel, Roanoke, Va.

28-30..SGA Advisory Council & Management Conference — Grand Hotel, Point Clear, Ala.

1956

February

15-17..Tulsa Corrosion Short Course for Pipeliners (NACE) — Mayo Hotel, Tulsa.

March

12-16..National Association of Corrosion Engineers Annual Meeting — Hotel Statler, New York.

19-20..Indiana Gas Association — French Lick Springs Hotel, French Lick, Ind.

19-21..MidWest Gas Association — Hotel Fontenelle, Omaha.

22-23..New England Gas Association Annual Meeting — Hotel Statler, Boston.

22-23..Oklahoma Utilities Association Annual Convention — Oklahoma City.

April

4-6..AGA General Management Section Spring Conference — Conrad Hilton Hotel, Chicago.

16-19..AGA Sales Conference on Industrial & Commercial Gas —Hotel Roanoke, Roanoke, Va.

17-19..Southwestern Gas Measurement Short Course — University of Oklahoma, Norman.

16-18..National Conference of Electric & Gas Utility Accountants — Hotels Biltmore and Commodore, New York City.

19-21..GAMA Annual Meeting — The Greenbrier, White Sulphur Springs, W. Va.

23-25..Southern Gas Association Annual Convention—Dallas.

May

7-10..AGA Distribution, Motor Vehicles, and Corrosion Conference—Congress Hotel, Chicago.

10-11..AGA Gas Supply, Transmission & Storage Conference—Conrad Hilton Hotel, Chicago.

16-18..AGA Chemical Engineering & Manufactured Gas Production Conference — Philadelphia.

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It's easiest to work with... perfect balance . . . comfort-grip I-beam handle . . . handy pipe scale on hookjaw . . . easy-spinning adjusting nut . . . clean grip on pipe, no slip or lock.

It lasts longer... first guaranteed housing, won't break or bind . . . ever. Every wrench individually tested before shipment . . . and millions of them in use. Sizes 6" to 60"—end pattern, 6" to 36".

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Work-Saver Pipe Tools

GAS associations

Newly elected officers of the SGA are (from left, standing): D. E. Frieden, secretary; W. G. Wiegel, treasurer; C. M. Smith, 2nd vice president; E. R. Cunningham, chairman, advisory council. (Seated) R. A. Puryear Jr., 1st vice president; J. H. Collins Sr., president.

SGA attracts 1989 people to New Orleans for meet

With a backdrop of the historic French Quarter and "steamboats on the Mississippi," 1989 delegates and visitors converged on hot, humid New Orleans for a record-breaking Southern Gas Association 1955 convention in mid-May. From the meetings, it is obvious that the problems vexing the southern segment of the gas industry are, in the main, parallel and similar to those facing other parts of the national gas industry.

One of these problems is the "softness" of the gas appliance market. T. T. Arden, executive vice president, Robertshaw-Fulton Controls Co., Long Beach, Calif., and president of GAMA, told the utility men that the formula for success in the present United States economy is somewhat similar to a Siamese-twin of sales and promotion, and only through those can the multi-million gas industry maintain and expand its present position. In his address, he pointed out that the appliance manufacturers considered business at this time "not too hot." This problem has been brought out in many of the addresses at industry conventions this year; however, as in the case of the other conventions, concrete answers to the problem were not readily available. Mr. Arden did point out that mass merchandising, such as that we commonly see in the nation's press, radio and television promotions is equally responsible, along with our famous know-how, for the progress that has been made toward attaining America's golden age.

Mr. Arden believes that most gas appliance manufacturers have learned the lesson of merchandising and are spending the limit on advertising and sales promotion of their product. "Manufacturers cannot exist without sales," he said, "and you can't have sales without a customer. It's up to the rest of the gas industry to give the manufacturers a hand . . ."

Middle management, an ever-increasing concern of the gas industry, was highlighted in a speech by C. I. Wall, Lubbock, Texas, the SGA's 1954-55 president. Mr. Wall said, "No one knows better than you of top management, you who have come up through the ranks, the vital importance of middle management. These are the men who rub elbows with your customers—they are the ones who must answer questions coming up and coming down."

Merryle Stanley Rukeyser, commentator and analyist of national-world affairs, told the convention that an industry or product cannot go along for a "free ride" on the rapid rise and future promise of economic growth. In this favorable picture, there is always a weeding out of obsolete, outmoded products and concepts which fail to win sufficient votes at the market place in the daily consumers' plebiscite.

F. M. Banks, president of the AGA and of his company, Southern California Gas, offered a four-point sales program for the southern gas companies:

1. Intensify research and promotion.
2. Form more demonstration-city programs.

Fred Westin (left), New Jersey Public Service, passes the gavel as retiring president of the Public Utilities Advertising Association to Raymond W. Fenton, Peoples Gas Light & Coke Co., newly elected president. The occasion was the recent annual convention of the group, which attracted 275 people to Chicago.

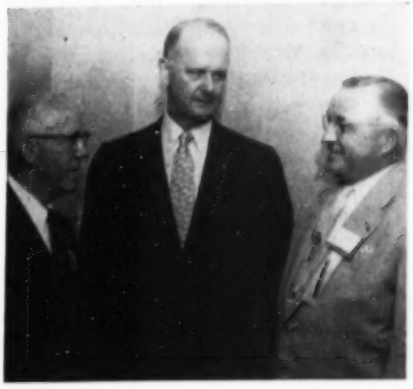
The newly PUAA-sponsored "gas copy forum" was attended by 54 persons. From left are George Webber, Michigan Consolidated; Phillip Atlas, Northern Indiana Public Service; Frank Lietz, Northern Illinois Gas; Raymond Fenton, Peoples Gas Light; and Norval Jennings, AGA.

3. Inform the public of the modernity and safety of gas service and appliances.

4. Work together with all segments of the industry.

SGA conventioners relaxed for entertainment and refreshment aboard the Mississippi river boat, "S. S. President" for a friendship-hour afloat hosted by the associate (manufacturer) members. Cocktails, a buffet dinner, and dancing in the ship's ballroom were available at this single well-attended function of the meeting. The cruise produced a gala evening that was enhanced by the first public appearance of the new Mrs. America for 1955, Mrs. Ramona Deitemeyer of Lincoln, Neb., who arrived by plane. She attended a press conference for members of the fourth-estate and was then whisked aboard the ship for the trip on the mighty Mississippi.

At the convention's closing, new officers were announced. The president for 1955-56 will be J. H. Collins Sr., New Orleans Public Service, Inc.; his



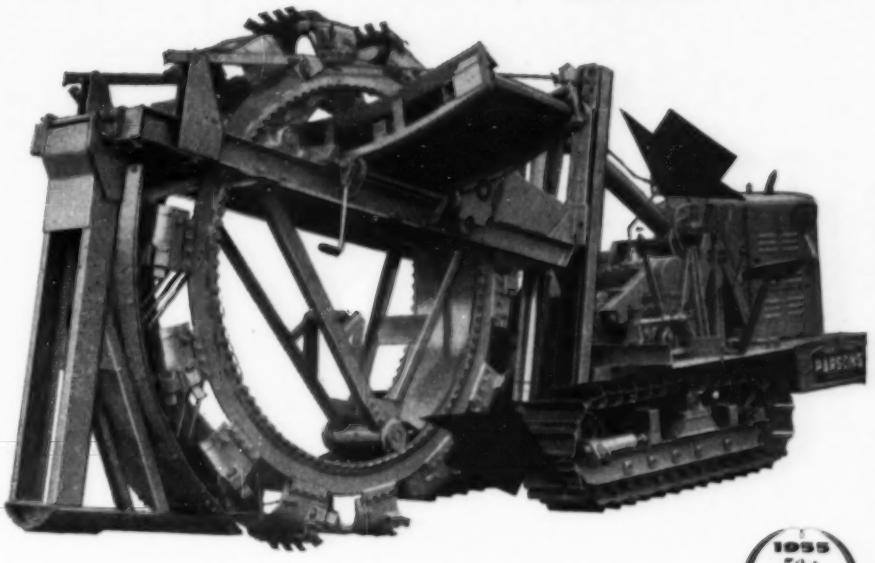
Two speakers at the SGA convention, T. T. Arden (left) and F. M. Banks (center), chat with the newly elected president of the group, J. H. Collins Sr.

first vice president will be R. A. Puryear Jr., Alabama Gas Corp., Birmingham. Other new SGA officers will be: Curtis M. Smith, vice president, Tennessee Gas Transmission Corp., Houston, second vice president; Dale E. Frieden, president, Zenith Gas System Inc., Alva, Okla., secretary; Willard G. Wiegel, treasurer, Lone Star Gas Co., Dallas, treasurer; Kyle H. Turner, supervisor of general accounting, Atlanta Gas Light Co., assistant secretary.

Chairman of the advisory council is E. R. Cunningham, vice president, Texas Eastern Transmission Corp., Shreveport. Vice chairman is A. H. Weyland, president Arkansas Louisiana Gas Co., Shreveport.

New directors are Richard W. Camp, president, Consolidated Gas Utilities Corp., Oklahoma City; Oliver W. Clark, vice president, Southern Natural Gas Co., Birmingham; Buell G. Duncan, president, Piedmont Natural Gas Co.

hydraulic power raises, lowers, *tilts* the digging wheel



1955 50th ANNIVERSARY PARSONS COMPANY

It's the NEW Parsons 150 Trenchliner!

Hydraulic wheel-hoist gives smooth, positive control of digging depth on the new Parsons 150 Trenchliner. A hydraulic ram on vertical mast raises and lowers the digging wheel, makes it easy to maintain accurate grade tolerance at any depth. A separate hydraulic ram tilts the mast — balances the weight of the wheel forward on the machine when traveling, loading or unloading on truck or trailer.

Simple mast design on the new 150 Trenchliner eliminates unnecessary superstructure, gives low overhead clearance for work and travel.

30 digging feeds from 12 inches to 25 lineal feet per minute sets a fast pace on pipeline, drainage, irrigation and utility trenching. (Tile box and chute optional.)

6 trench widths range from 16 to 26 inches wide. Maximum digging depth is 5¾ feet.

Quick-change buckets, solid-type or tine-back, are available with gumbo lips or self-sharpening, reversible "Tap-In" teeth for digging dry or wet materials. Buckets are all cast-steel.

Dual-purpose friction clutch drives the digging wheel and serves as an automatic safety to protect machinery against shock loads.

Shiftable, reversible belt conveyor, 24 inches wide, discharges spoil to either side. There are 3 speed selections on the conveyor.

Standard tractor crawlers have 16-inch treads, lug-type shoes or 12-inch treads with flat shoes. Only 6 or 8 lbs. PSI bearing pressure, depending on tread width.

Gas or diesel power — you have a choice of 58 h.p. gas engine, or 58 h.p. diesel.

All main gears enclosed in oil, all main shafts mounted on antifriction bearings assure dependable performance with Parsons 150 Trenchliner.®

PARSONS

Want more facts?

Reynolds OFFERS A NEW PERFECTED SAFETY CONTROL FOR ALL SERVICE REGULATORS

Reynolds' new Safety Control may be attached to any Reynolds spring type service regulator built in the last fifteen years.

GAS CONTROL SINCE 1892

* **Prevent regulator from falling in a wide open position, thus limiting the amount of gas the safety seal has to pass.**
* **Enable the gas company to set the regulator for a certain demand and if a customer increases that, his outlet pressure would drop which would cause him to call the company and they can find out what his real demands are.**

REYNOLDS GAS REGULATOR CO.
ANDERSON, INDIANA

1897 1955

PIPE STOPPERS OF ALL KINDS

SAFETY GAS MAIN STOPPER COMPANY

GOODMAN USED SINCE 1897 2" HANDLE & LOCKING SLEEVE GAS MAIN STOPPER

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associations • *Continued*

Inc., Charlotte, N. C.; Donald M. Mayne, regional manager, Servel Inc., Dallas, and C. B. Reinschmidt, vice president, South Atlanta Gas Co., Savannah.

The 1956 SGA meeting will be held April 23-25 in the newly enlarged Hotel Adolphus and the new Statler-Hilton hotel in Dallas.

Personnel men elect John Wilson chairman

John M. Wilson, director of employee relations, United Fuel Gas Co., Charleston, W. Va., was elected chairman of the Great Lakes Personnel Conference of the AGA at a recent meeting. The meeting was addressed by Arthur W. Luchs of the Federal Mediation and Conciliation Service. He presented, through slides and recordings, the handling of actual grievance cases. General discussion by the group followed.

Also elected officers of the conference were W. E. Hoare, employee relations director, The Ohio Fuel Gas Co., Columbus, vice chairman; and Emory A. Manlove, assistant to the vice president of The Peoples Gas Light & Coke Co., secretary for the coming year.

GAMA divisions recommend 16 trade shows for display

Participation in one or more of 16 different national and regional trade shows has been recommended by the various divisions of GAMA, according to H. Leigh Whitelaw, managing director of the organization.

Recommendations were made by individual division trade show committees that investigated various shows and recommended only those shows or exhibits they believed were of particular benefit to the members of their divisions.

The following are the recommendations:

Domestic gas range division—National Association of Home Builders convention and exposition (Chicago), LPGA national show, American Furniture Mart, Western Furniture Mart.

Hotel, restaurant and commercial gas equipment division—National Restaurant Show, National Hotel Exposition, American Dietetic Association show, New England Hotel and Restaurant show.

Automatic controls division—International Heating and Ventilating Show, LPGA national show, Air Conditioning and Refrigeration Institute, Institute of Appliance Manufacturers.

Gas refrigeration division—National Food and Women's Page Editors of Metropolitan Daily Newspapers con-

vention, National Association of Home Builders convention and exposition, LPGA national show, American Furniture Mart.

Gas clothes dryer division—National Association of Home Builders convention and exposition (Chicago), LPGA national show, National Housing Center (Washington, D. C.).

Gas water heater division—National Association of Home Builders convention and exposition, LPGA national show, Plumbing and Heating Exposition.

Direct heating equipment division—National Association of Home Builders convention and exposition, International Heating and Ventilating show, LPGA national show.

Gas boiler division—National Association of Home Builders convention and exposition, International heating and Ventilating show, National Plumbing and Heating exposition.

Relief valve division—International Heating and Ventilating Show, National Plumbing and Heating Exposition.

Vented recessed heater and floor furnace division—National Association of Home Builders convention and exposition, LPGA national show.

Gas furnace and conversion burner divisions—International Heating and Ventilating Show.

Gas meter and regulator division—AGA distribution conference.

Industrial gas equipment division—National Metal Exposition.

Gas appliance regulator division—National Association of Home Builders convention and exposition.

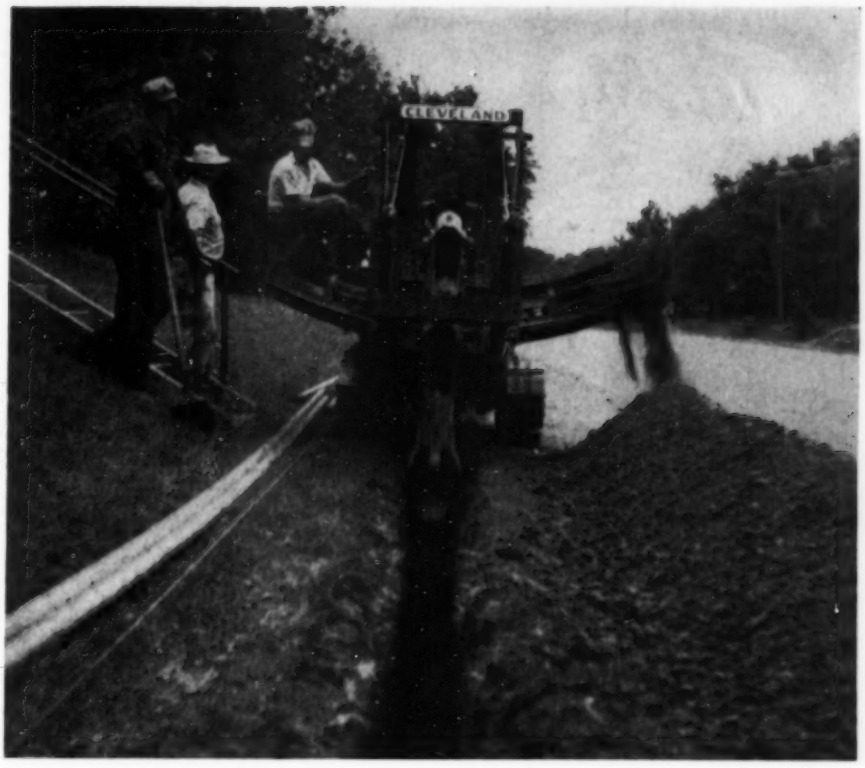
Reservations for AGA-PCGA meeting top estimates

Advance reservations for the 1955 AGA-PCGA convention at Los Angeles have passed the 1800 mark, topping previous estimates by a wide margin. This was one of the highlights reported at a recent planning meeting of subcommittee chairmen.

Housing, entertainment and transportation arrangements now are geared to a total registration of 2500 delegates and 1000 wives, and large blocks of rooms in the city's leading hotels have been reserved for this number. The Statler, Ambassador, and Biltmore hotels will serve as focal point for the 1955 conclave; all general sessions and sectional meetings are scheduled at one of the three.

Heading the general convention committee is R. R. Blackburn, Southern California Gas Co., assisted by Kurwin Boyes, AGA, and J. E. Kern, PCGA.

Working under the general committee are these subcommittee chairmen: housing, R. F. Ogborn, SoCal; registration, G. S. Coates, Southern Counties



Repair cost = $\frac{1}{50}$ ¢ per foot on 120,000 feet of extension work

CENTRAL ELECTRIC & GAS CO., Lincoln, Neb. with their Cleveland "Baby Digger" consistently dig an average of about 200 feet of trench per hour . . . a good production average on gas extension projects where numerous line obstacles are encountered both above and below ground.

Their Cleveland, shown above working easily along the edge of a lawn, recently completed more than 600 hours of trench digging—about a half year's work on use of this kind—with no need of repairs or parts replacement due to wear, or maintenance of any kind except normal lubrication and fueling. (One shaft was broken by improper sprocket installation during the regular operator's vacation, at a cost of $28.)

Performance like this—plus compactness and maneuverability, big capacity, and dependability in turning out high daily footage regardless of soil and weather conditions—goes a long way toward explaining why Cleveland "Baby Diggers" have been the gas industry's choice in trenchers for well over 30 years.

Fast moving, too! . . . Cleveland "Baby Diggers" hustle safely from job to job . . . at legal speed limits . . . because they are so easily portable on fast loading Cleveland trailers.

Write for Full Line **CLEVELAND** *Bulletin or see your Local Distributor*

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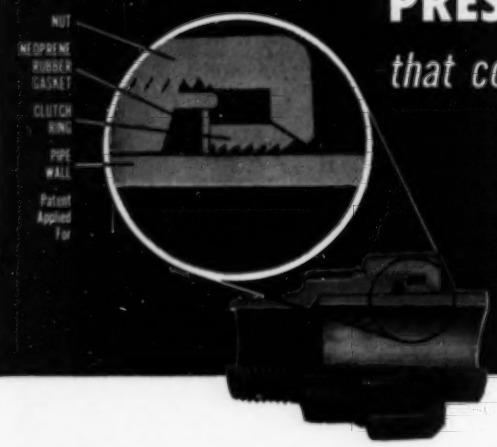
PRESSURE FITTING
that conducts electricity



Telsco Long and Short Couplings, Adapters, 90° Elbows, and Tees, ½ through 2 inches.

Use Telsco Fittings on Plastic Pipe, too—Metal Stiffeners for this application are available.

The unique sealing principle used in Telsco Threadless Fittings concentrates great pressure, under containment, on *all sides* of a *small* rubber gasket (See cross section). Under this tremendous pressure, confined in a small area, the gasket forms a tight seal against leaks.

At the factory every Telsco Fitting gets a 90-pound air pressure test, under water—assuring a sound casting every time.

Telsco Fittings do not insulate. Instead they conduct static electricity without the time, effort and cost of bonding every connection.

TELSCO FITTINGS DIVISION
5420 REDFIELD STREET DALLAS 19, TEXAS

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A LIQUEFIED PETROLEUM GAS OF HIGHEST QUALITY

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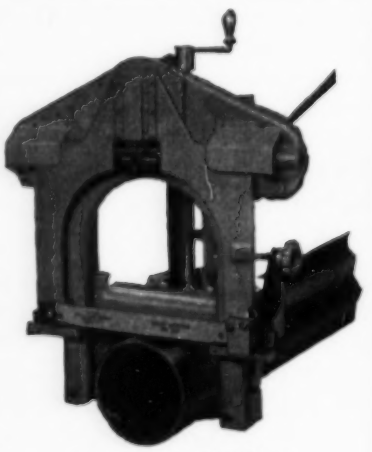

NEW WACHS
PORTABLE POWER SAW
No Flame—Safe Cuts Under Hazardous Conditions!
FASTER—SAFER—ACCURATE!
Cuts 2", 4", 6" & 8"
Cast Iron and Steel Pipe
WACHS GUILLOTINE SAW FACTS—
- Cuts Fast
- Cuts Clean
- Cuts Square
- Height 28"
- Width 22¼"
- Depth 12"
- Set up time, less than one minute
- Power—electric or air motor
- Weight 105 pounds

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associations • *Continued*

Gas Co.; entertainment, F. N. Seitz, So. Counties; properties, W. A. Wilson, SoCal; local transportation, C. A. Renz, SoCal; convention publicity, J. T. Van-Rensselaer, SoCal; and hospitality, F. A. McCanlies, SoCal.

AGA labs advance veteran engineers

Two veteran engineers at the AGA Laboratories, Frank E. Hodgdon and Russell V. Myer, have been named assistant directors.

In his new assignment, Mr. Hodgdon will have supervision of the standardization program for gas appliances and accessories, and methods activities in connection with approval requirements preparation. Mr. Myer will head the appliance approval testing and field inspection program.

Others promoted were Carl F. Geltz to chief testing engineer, Thomas Leitch to chief inspection engineer, and Frank Miller to assistant chief inspection engineer.

Pros and cons of natural gas discussed by gasmen

Peninsular Florida, being more than 750 miles from the nearest pipeline, is vitally concerned with the subject of natural gas, and the pros and cons of this subject were explored thoroughly at the annual general management conference of the Florida-Georgia Gas Association held in Miami recently.

At the start of the three-day session, John C. Bolender, vice president and general manager of Peoples Water & Gas Co., North Miami, was elected president. Joseph Frink will continue as secretary-treasurer.

W. E. Tippy, executive vice president of Commonwealth Services Inc., delivered what amounted to a rebuttal of the arguments presented by F. E. Stanley, chairman of the board of Houston Texas Gas & Oil Corp., which plans to build a line to Florida. Making a strong plea for the manufacturers of synthetic natural gas, Mr. Tippy asserted that only a small percentage of saving would come about with the construction of the line, but there is no tangible assurance that any appreciable savings would occur in the long run.

The problems of finance in relationship to the distributing companies was dealt with by Phillip C. Crowen, president of Peoples Water & Gas Co. He cited his own company as an example of plant modernization and showed how with the investment of more than $4 million, it has reached a point in development that precludes any dependency on the introduction of natural gas.

Management section names H. S. Walker as secretary

Harold S. Walker Jr., formerly of Lit Bros., Philadelphia, has been appointed secretary of the AGA's general management section, succeeding Harrington A. Rose, who resigned recently to join Transcontinental Gas Pipe Line Corp.

A graduate of the U. S. Military Academy at West Point, Mr. Walker served with the army from his graduation in 1943 until September 1954, when he resigned with the rank of major. He joined Lit Bros. division of City Stores Inc. in November 1953. He was in charge of customer and merchandising service for floors handling home furnishings, appliances, furniture, and house wares.

GAS association notes

Modernize - mechanize - merchandise was the theme of the 36th annual National Restaurant Exposition on the Navy Pier, Chicago, recently. With a registration of visitors topping last year's record attendance by 15%, nearly 30,000 visitors thronged the four miles of main aisles of this largest industry show.

Again spanning the giant pier at about the midway point, AGA Combined Commercial Gas Cooking Exhibit was seen by all of the visitors as they made the rounds of the exhibits. The 14 cooperating exhibitors under the Blue Flame banner stressed speed and efficiency in the display of modern volume cooking equipment.

The AGA has released the first issue of *Fotofile*, a new photographic service to member gas companies. Periodically, *Fotofile* will publish the latest eye-catching illustrations collected from sources through the industry. Some of the ways the pictures might be put to use are suggested.

New officers of the Wisconsin Utilities Association are Carl J. Forsberg, Wisconsin Power & Light Co., president; D. B. W. Brown, Milwaukee Gas Light Co., vice president; and Harold P. Chamberlin, Wisconsin Electric Power Co., reelected treasurer.

New officers of the Society of the Plastics Industry are Norman Anderson, president of General Molded Products Inc., president; John J. O'Connell, Consolidated Molded Products Corp., outgoing president, chairman of the SPI board; Alan S. Cole, Breskin Publications Inc., vice president; William C. Bird, Prolon Plastics, secretary-treasurer.

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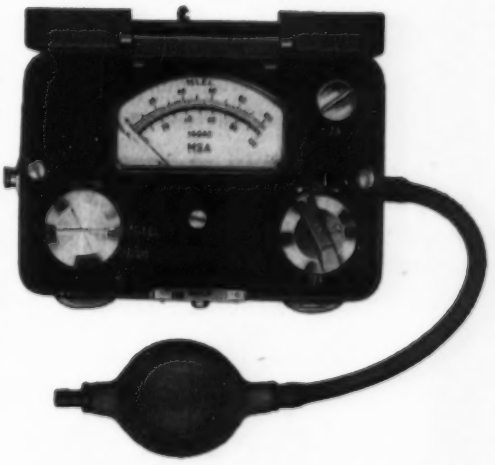

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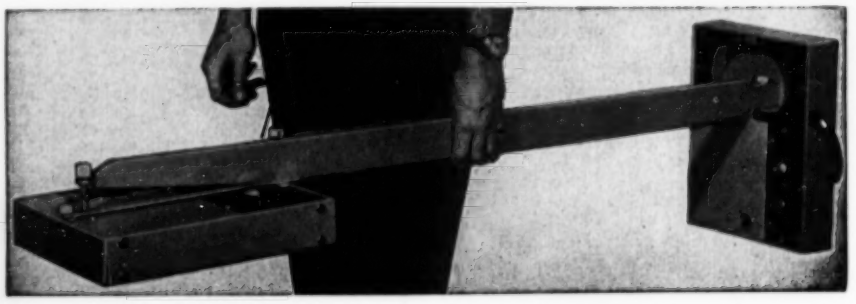

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Promotions

J. H. Wimberly **F. C. Smith**
Houston Natural

JOHN H. WIMBERLY, who has been executive vice president since 1947, has been elected president of the Houston (Texas) Natural Gas Corp. FRANK C. SMITH, who has been president since 1933, was elected chairman of the board of directors. He succeeds the late L. S. ZIMMERMAN. In addition, CECIL E. BURNEY has been elected to the board.

F. J. BASSETT, manager of the Taunton division of the Brockton (Mass.) Taunton Gas Co., has been elected vice president.

GEORGE G. LINDHOLM, manager of the Chicago branch of Crane Co., is now manager of the company's valve and fitting department. He succeeds F. J. WILKEY, who is now special representative of the industrial sales division. THOMAS D. KELLY succeeds Mr. Lindholm as Chicago manager.

Bailey Meter Co., Cleveland, has announced that PAUL S. DICKEY, former vice president and a director, is president, succeeding ROBERT S. COFFIN, who was elected chairman of the executive committee and named management consultant. HARVARD H. GORRIE, chief engineer, is now vice president in charge of all engineering activities and RAYMOND D. JUNKINS, head of the patent department, has been elected a vice president and director.

FRANK F. ELLIOTT, senior vice president of sales for Crane Co., Chicago, since 1952, has been elected president and chief executive officer of the company, succeeding JOHN L. HOLLOWAY, who resigned because of ill health.

HOWARD S. BUNN has been elected vice president and member of executive committee of Union Carbide & Carbon Corp., New York. The company also elected DR. AUGUSTUS B. KINZEL vice

president-research, succeeding DR. GEORGE O. CURME JR., who is retiring as an vice president but will continue as a director.

RODGER M. BLOUGH has succeeded BENJAMIN F. FAIRLESS as chairman of the board and chief executive officer of United States Steel Corp. Mr. Fairless will continue as a member of the board of directors and the finance committee.

MRS. GERTRUDE MCKIM has been elected secretary of the Roberts-Gordon Appliance Corp., Buffalo, N. Y.

A-P Controls Corp., Milwaukee, has named VINCE REYNOLDS as sales representative in the Dallas office.

Cooper-Bessemer Co., Mt. Vernon, Ohio, has elected S. E. JOHNSON JR. assistant secretary and assigned DONALD E. DIXON to the Tulsa office as field engineer.

J. H. LOOMIS has been appointed manager of Worthington Corp.'s St. Louis office.

GLYN A. NEFF has transferred from the engineering division of Consolidated Engineering Corp., Pasadena, Calif., to the systems division, where he will be project chief for data processing systems.

MILTON W. GREGORY has been appointed manager of bonded mat sales of the L. O. F. Glass Fibers Co. He will headquarter in Toledo.

RICHARD J. STAMBERGER, New York district sales representative for the Youngstown Sheet & Tube Co., has been appointed assistant New York district sales manager.

P. C. Kreuch **E. F. Foubert**
Rockwell Manufacturing

PAUL C. KREUCH, assistant to the vice president in charge of Rockwell Manufacturing Co.'s meter and valve division, has been named a vice president in that division, and EUGENE F. FOUBERT, manager of industrial relations for the company, was named vice president-industrial relations.

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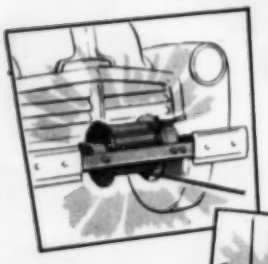

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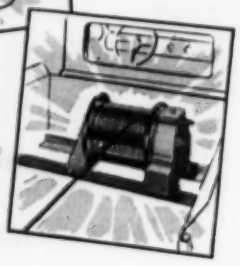

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people • *Continued*

T. G. Nelson
Honeywell

J. A. Scanlon
Columbia Gas

TAYLOR G. NELSON, formerly eastern appliance controls sales manager for Honeywell, has been named sales manager for the Appliance Controls division of Minneapolis-Honeywell Regulator Co. as part of the company's expanding production and sales program in southern California.

JAMES A. SCANLON, vice president of the Ohio Fuel Gas Co., has been appointed vice president of the Columbia Gas System Service Corp. in New York. His new duties will be with the rate department.

J. MASON GUILLORY, director of advertising for New Orleans (La.) Public Service Inc., has been elected a vice president of the company.

FRANCIS A. KEANE, who has been assistant comptroller of Public Service Electric & Gas Co., Newark, since 1945, has been named assistant to the president.

PAUL L. LYONS has joined the Sinclair Oil & Gas Co. as chief geophysicist.

WILLIAM F. CATHCART, Cleveland territorial manager of the cooking appliance controls division of Robertshaw-Fulton Controls Co., has been assigned to special engineering duties at the Robertshaw Thermostat division in Youngwood, Pa. D. REX SCOTT replaces him in Cleveland.

W. F. Cathcart

D. R. Scott
Robertshaw

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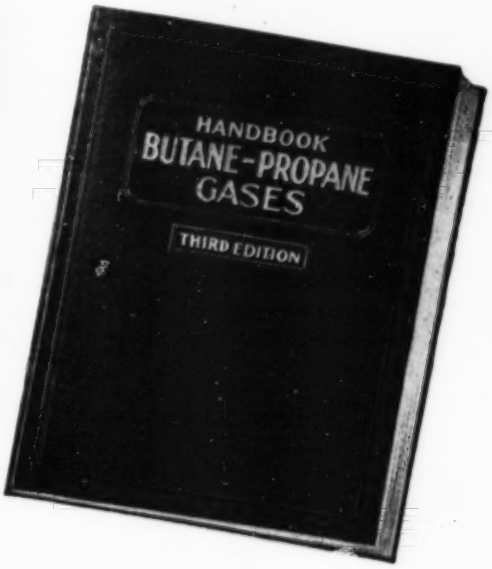

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W. W. Wigle W. L. Beers
Sherman Products

Sherman Products Inc., Royal Oak, Mich., has promoted WALTER L. BEERS to manager of the northwest section and WILLIAM W. WIGLE, Canadian manager, to products specialist in the home office.

New faces

CARY M. ABNEY, Marshall, Texas, and W. T. MURPHY JR., Texarkana, have been elected to the board of directors of Arkansas Louisiana Gas Co., Shreveport.

RICHARD W. C. BARR has joined General Controls Co., Glendale, Calif., as manager of the Boston branch, succeeding WILLIAM J. DARRAGH, who is now manager of the New England district office in Hartford, Conn.

MILTON G. PECK has joined Gar Wood Industries Inc., Wayne, Mich., as vice president and director of sales and advertising.

BRIAN E. BRENNAN has joined Servel Inc., Evansville, Ind., as manager of manufacturing in the home appliance division. Servel also announces that MARK R. MILLER has been appointed general manager of the company's defense division.

Logistics Research Inc., Redondo Beach, Calif., has announced that Sir ROBERT ALEXANDER WATSON-WATT has been named president and board chairman. He is credited with the discovery and development of radar.

Honors

WILLIAM R. MCLAUGHLIN, southwestern regional sales manager of Rockwell Manufacturing Co.'s meter and valve division, has received a scroll from the executive committee of the Southwestern Gas Measurement short course in honor of his 32 years of service to the course. Mr. McLaughlin was recognized as the only past chairman of the short course who had participated in every short course since the first one in 1924.

Deaths

T. H. STERLING, vice president of Oklahoma Natural Gas Co., died recently. Before his appointment as vice president last year, Mr. Sterling had served as preferred stock sales manager, and district manager at Enid and Oklahoma City.

EDWARD JOHN TUCKER, 65, vice president and general manager of the Consumers Gas Co., Toronto, died recently. Mr. Tucker, who retired about a year ago, was a past president of the Canadian Gas Association and a past director of the AGA.

HOWARD FERRIS, veteran gas industry heating salesman, died recently. Mr. Ferris, 46, served for 23 years in various capacities at Day & Night division of Carrier Corp. For the past 6½ years, he was with Kresky Manufacturing Co., Petaluma, Calif., as general sales manager of the Ward Heater Co. An active member of the PCGA, Mr. Ferris was vice chairman of the water heater division of the manufacturers section in 1949-50.

ROBERT C. WOODWARD, who had retired only last December after serving 20 years as chief metallurgist for Bucyrus-Erie Co., died suddenly after a short illness. He was 68.

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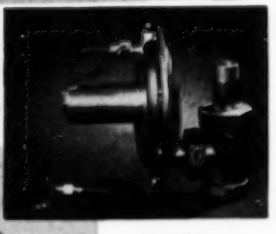

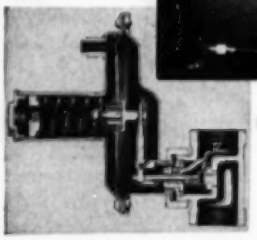

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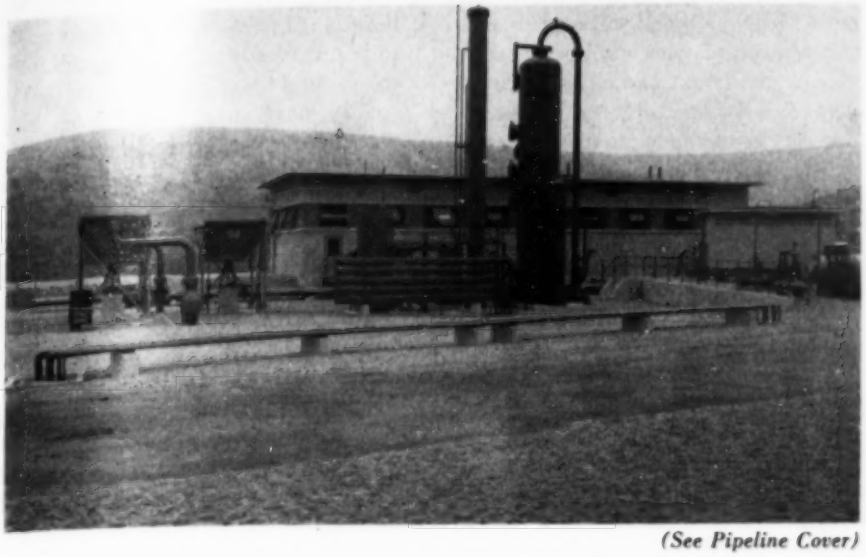


(See Pipeline Cover)

GAS

JULY 1955

How good-neighbor policy made a storage field possible

A tremendous increase in population has occurred in California during the past several years and its impact has affected the natural gas industry. Not only has the local supply of gas been exceeded, but it has been necessary to contract for exceptionally large volumes of gas from El Paso Natural Gas Co. At present, the volume of gas being delivered into southern California from sources outside the state is approximately 705 MMcf per day. This gas, received at a relatively high load factor, along with the steady production of the majority of local gas, necessitates extensive means of equating firm load requirements which fluctuated from a minimum last summer of approximately 175 MMcf per day to a maximum of approximately 1300 MMcf per day during the past winter. In addition to possible fluctuations in gas supply, load equating is generally accomplished by curtailment of industry, purchase of emergency gas, curtailment of exchange gas for producers, and operation of gas storage facilities. Although all of these means of load equation have been developed as much as possible, during the past 15 years the development and operation of underground gas storage reservoirs has provided the principal increase in capacity for this important operation. In 1941, the first major underground gas storage reservoir in California was placed in operation at La Goleta gas field located approximately eight miles west of Santa Barbara. At the start of operations, the field had a daily deliverability of approximately 60 MMcf per day and an injection capacity of approximately 28 MMcf per day. Its development up to the present time has resulted in capacity to deliver gas at rates up to 460 MMcf per day and inject gas at rates up to 108 MMcf per day.

Along with Goleta, other gas storage fields have been developed by local gas companies, at Del Rey and East Whittier, until today they have a combined withdrawal rate in excess of 700 MMcf per day, and a combined injection capacity of approximately 185 MMcf per day. Even the development of these fields has not satisfied the gas companies' requirements for underground storage reservoirs. With the continual influx in population, peak day gas supply requirements increase at a rate of approximately 90 MMcf per year. Such an increase in demand will necessitate additional gas supply and development of additional gas storage capacity. This additional requirement for gas storage has made it necessary to give consideration to all oil and gas fields in which it might be feasible to carry on storage operations.

By RAYMOND W. TODD
Pacific Lighting Gas Supply Co.
Los Angeles

RESIDENTIAL developments have, in the past, eliminated consideration of some fields for storage operations as it was felt that such operations could not be carried on in the proximity of residential areas. However, approximately four years ago our company, seeking additional gas storage fields, was successful in negotiating the purchase of a small oil and gas field located immediately adjacent to the residential area known as La Habra Heights, located some 20 miles east of Los Angeles. This field was discovered in 1941 and produced substantial quantities of gas at rates up to 12 MMcf per day and a certain amount of oil over the next 10-year period. By 1951 the gas had been depleted and oil production had dropped below the economical limit. The field, wells, and other facilities were purchased by the company direct from the oil company which had owned and developed the field.

Surface, storage, and mineral rights were purchased to some 70 acres of property, which was located on the approximate top of the reservoir zone. In addition to rights to store gas beneath these 70 acres, rights were also acquired to store gas in the reservoir in the sur-

rounding 200 acres to be sure that we controlled the entire reservoir.

The field facilities, at the time of purchase, were in the general condition of most depleted oil fields—that is, debris had been left lying, old steel derricks were still in place, and in general the field operated as cheaply and as inexpensively as possible in view of the small amount of oil production. Housekeeping had been very poor. To be able to operate such a field, the most important job was to conduct all of the development and subsequent operations in a manner that would prevent objections by owners of surrounding residential property. Therefore, immediately upon purchase of the property, a cleanup campaign was started. Debris and junk were removed, the old derrick was dismantled, and conscientious effort was made to tidy up the property. The area on one side adjoined rolling hills over which brush and grass grew in abundance. It was necessary to obtain permission from the adjoining property owner to cut fire breaks across these hills; this not only protected gas company property, but was a great asset to the protection of the residential property.

Relations with local property owners

Soon after the acquisition of the field, contact was made with the local property owners association and meetings were scheduled with its zoning committee to acquaint the members with plans for the development of the natural gas storage field. Company representatives met with them on the property, discussed the proposed location of the compressor station (the site had been selected in as inconspicuous a place as possible), and outlined to them plans for landscaping the area surrounding the existing wells and station site area. The decision to meet with the property owners association and advise them of plans was prompted by the unsatisfactory experiences of some oil companies in this area, which had resulted from their taking the attitude that as long as they conducted their operations to comply with all legal requirements, they had no other obligations to the local property owners. As a result, many difficult situations ensued.

As soon as plans for the compressor station buildings had been completed, they were reviewed with the property owners association, so that they would be familiar with the type of buildings planned for erection. Approval by the property owners of our plans or of the project was not necessary, nor was it necessary to obtain any zoning variance for the operations. However, we are confident that had it been necessary to obtain permission, there would have been no opposition from the association. There is no question but what early acts of cleaning up the property and cutting fire breaks had demonstrated to them that the operating company wanted to be as neighborly as possible. Along this line, it was also learned that the property owners had developed a volunteer fire department, which was composed of residents in the immediate vicinity. A modest contribution to this organization not only assured their cooperation in the event assistance was needed, but also further evidenced the gas company's desire to become a part of the community.

It was evident that construction of compressor facilities and the drilling of injection and withdrawal wells would entail a large amount of heavy traffic on roads in the area which were normally carrying residential traffic. Inasmuch as there were several means of access to the storage field a survey of the various routes was made and access to and from the property was directed to be by the route which interrupted the least amount of traffic through the residential area. This route was posted so that all company personnel traveling to or from the property could readily find their way without having to stop and bother the local residents by asking directions. It was also realized that the largest amount of traffic would occur in the early morning and late evening when people travel to and from work and, therefore, directives specified that no equipment, unless ordered in an emergency, could travel to or from the job site during these hours and, further, that no heavy trucks or other noisy equipment could travel to the job site during the night hours. This provision has been written into all construction contracts and all contractors have had to agree to comply with it.

Noise abatement

Several steps were taken to reduce the noise level to the lowest practical minimum. First, all engines were equipped with the best mufflers available. Second, main compressor buildings and auxiliary buildings were constructed with concrete block walls and flat steel roofs covered with built-up surface coated with coarse aggregate. An investigation of various types of soundproof buildings indicated that this type of construction had the best sound-absorbing characteristics within practical construction costs. *Table 1* gives some idea of the construction costs and sound-absorbing characteristics of the different styles of buildings considered.

Third, blow-down stacks for emergency blow-down of the plant or blow-downs of pipe systems, which might be necessary as a result of alterations or changes, were also equipped with mufflers. Fourth, trees were planted along the sides of the compressor station site which adjoined the residential property.

In addition to the precautions taken in the planning of the compressor station facilities to eliminate as much noise as possible, it was also necessary to give consideration to this problem in drilling the additional injection and withdrawal wells. In this matter, generally accepted well drilling practices were followed with the exception that the rigs were completely insulated with glass fiber mats, which practically eliminated all noise from the well drilling equipment.

TABLE 1. ACOUSTIC QUALITY AND COST OF BUILDING WALL TYPES
(100 to 120 decibel on interior)

Type of Wall	Sound Transmission Loss in Decibels	Interior Noise Reduction Coefficient	Construction Cost Per Sq Ft of Wall Area
8-in. concrete block with filled cells	55.00	0	$1.10
Corrugated transite on steel frame with 2-in. Insulrock	20.00	0.80	$1.22
Rockwood Bett in 3¼-in. Q-panel with 1¼-in. Acousti-Celotex on 1-in by 3-in. furring	61.60	0.75	$1.32
8-in. concrete (poured)	55.00	0	$1.33
2-in. steel studs staggered and laced with 1-in. rockwool between two ¾-in. plaster panels	55.70	0	$1.45

Plant appearance

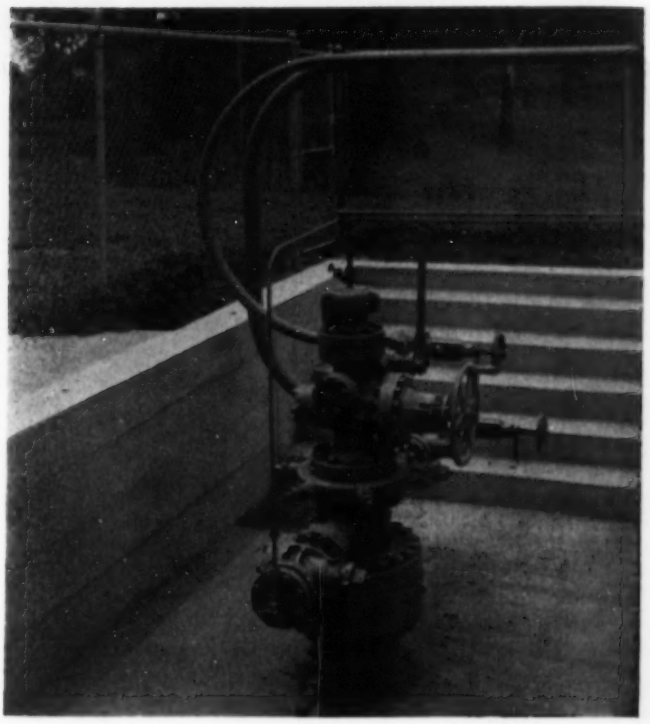
With regard to appearance, the first step was to plan the main compressor building and auxiliary building along California-modern lines. The flat, extended roof, the concrete block construction with horizontal mortar joint emphasized, along with a horizontal window pattern, all combined to give a low-appearing building which blended in with the extended, covered passageways along the office part of the auxiliary building to give a pleasing appearance. The facilities in the plant were located so that mufflers and air cleaners were on the side of the plant away from residential development so that these unsightly portions of the installation would be as nearly concealed as possible.

It had been standard practice with our company to paint all buildings and exterior piping with aluminum paint. Obviously, at East Whittier, such a practice would be very undesirable from an appearance standpoint. Therefore, an industrial color consultant was hired to work out a color scheme of light tans and shades of green for the building and all exterior piping. This color scheme has proven so pleasing that it is being adapted for the balance of our plant facilities. The same general color scheme was selected for inside the station building, using light green engine enamel in place of the old dark gray, which had formerly been used on engines. The color not only improved the general interior appearance, but also increased visibility around concealed engine areas at least 100%. Employees find that the new color scheme makes it much easier on their eyes and they state that they feel that working conditions have been materially improved.

Landscaping consultants were also commissioned to plan a planting scheme in the vicinity of the compressor station building and around each of the wells. The planting of protective growth around the wells was suggested by the fire department in order to eliminate the growth of weeds and brush which, when dry, would produce a fire hazard.

Design of facilities

The design of the compressor station facilities in general followed modern plant design. All facilities installed were designed in accordance with ASA B 31.1 code provisions and were sized to meet anticipated capacities. The first group of compressor units installed included three 440-hp Cooper-Bessemer GMV-4 units. This size was selected in order to meet fluctuating load conditions which might be incurred in injecting gas. Auxiliary facilities installed in conjunction with the compressor station included electrical generating facilities for plant and field use. Three high-speed gas-engine driven 125 kva generator units are used for electric generation. All service functions in connection with the operations at East Whittier are electric motor-driven in order to reduce total noise level to a minimum. Generation of our own electric power is considered essential, inasmuch as the functioning of the field could be nullified in the event of an outside power failure.



Contrast this neat wellhead, surrounded by ice plant, with the usual gas well location. Color scheme has been carried out on christmas tree and piping.

Field operation

Plant facilities were designed to operate at pressures up to 1200 psig, although to date the maximum wellhead pressure in the field has been 730 psig, which is approximately the original discovery pressure.

As the field is developed, it is anticipated that we will gradually increase the maximum storage pressure to approximately 900 psig. During periods of withdrawal, gas is delivered into the transmission system at pressures of about 250 psig without compression.

This field has been operated as a gas storage reservoir for approximately two years; therefore, a definite pattern of its operating characteristics has not been established. We do know that gas injection and the resulting reestablishment of pressure in the formation has resulted in the displacement of a certain amount of water. Proof of this comes from increased pressure in wells completed in the wet zone. At the start of storage operations these wells showed no pressure, but since the reestablishment of pressure in the zone, they have shown a definite build-up of several hundred pounds pressure. Therefore, ultimate working capacity of the reservoir cannot be definitely established. At the present time, there is an indication that the reservoir has a working capacity of 1.4 billion cu ft of gas. To date, we have injected a cumulative total of approximately 1750 MMcf, while withdrawing a total of 1145 MMcf. Although total working storage capacity is small (as compared to Goleta, for example), the proximity of the storage reservoir at East Whittier to a load center makes its operation very important.

At the present time, the compressor station is being increased to 2700 hp and four additional wells will be drilled this summer. These will increase withdrawal capacity to 50 MMcf per day. In view of the strategic location of this field, it is anticipated that the reservoir will ultimately be operated in much the same manner as aboveground gas holders are operated by distributing companies. That is, the reservoir will not only be used to help equate annual loads but will also be used to equate daily and hourly load fluctuations. ■

This article is adapted from a talk presented at the PCGA transmission conference in May.

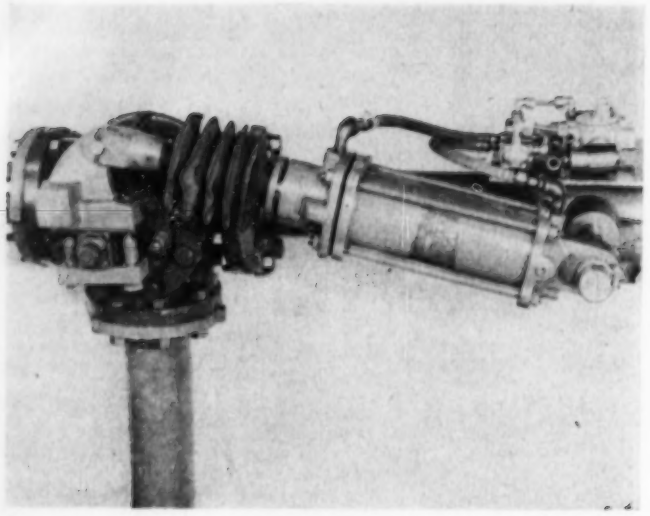


Fig. 1. Cylinder operator manufactured by Hannah Engineering Works.

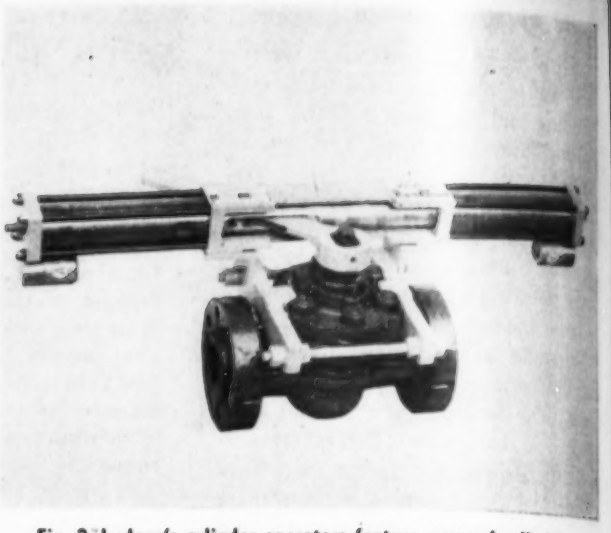


Fig. 2. Ledeen's cylinder operators feature opposed cylinders.

Valve operators for lubricated plug valves

. . . a study of the various powered operating devices that are mounted on, and used with, plug valves

By T. H. M. TAYLOR, Chief Engineer
Nordstrom Valve Division, Rockwell Manufacturing Co.

IN PAST years, manual operation of valves was quite satisfactory. Gradually, however, powered valve operators have been designed into installations until today their use is widespread. Virtually all commercially available power units are relatively straight-forward in design, with both rotational and linear mechanisms giving satisfactory service.

The control circuits for powered operators, on the other hand, have become quite complex, and are capable of adapting the valves to a variety of services requiring automatic or special controls.

In general these control circuits follow normal instrumentation practice, modified and complicated by varied conditions encountered in plug valve installations. Some systems use plug valves as regulators for controlling line pressure, others are used as automatic safety shutoff valves for tranmission-line breaks. Some control devices operate valves on a time cycle as required for catalytic reforming processes in oil refineries. Other control circuits are used for remote operation of valves, such as the microwave, radio-controlled systems designed for gas transmission lines. Still other circuits are used for automatically sequencing valves in compressor and pumping stations.

In this discussion, rather than treating the technical intricacies of elaborate control systems, let's examine the various powered operating devices that are mounted on, and used with, plug valves.

Many companies manufacture units that are not specifically for lubricated plug valves and consequently a degree of engineering compromise is sometimes required. It is also apparent that a good powered operator is not easy to design and has a tough job to do. A valve operator may be required to perform its tasks in the temperature range of —100° F to 150° F. It must be waterproof, dustproof, tamperproof, and what might be called maintenance-proof. In addition, it must be capable of exerting considerable torque under stall conditions; also, it should be small in size and low in cost.

Choosing the power source

In applying a powered operator to a lubricated plug valve, the primary source of power must first be chosen. In the case of a high-pressure gas line, there is usually no particular difficulty in using pipeline pressure for this purpose. However, for a pipeline carrying a liquid, this source of primary power would normally not be practical and it would be necessary to supply an electrical service, or some other energy source, for the operator. In the case of the so-called automatic valve which closes for a line break, the rate of change of pipeline pressure is required to actuate the valve, and if the pipeline fluid cannot be used as the power source, a control instrument of some kind must be used; usually, this consists of a pres-

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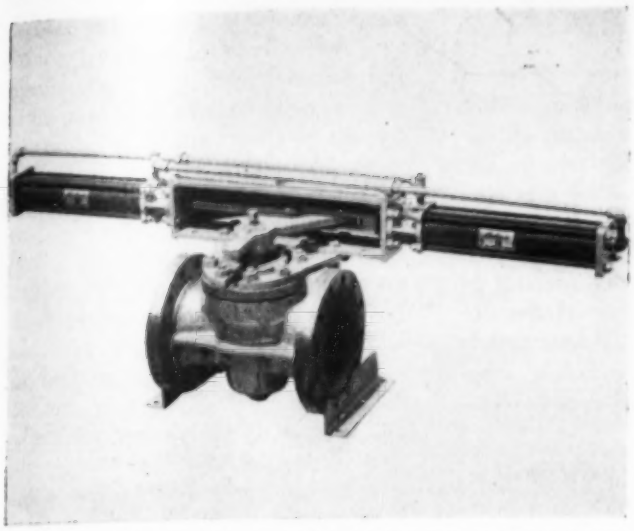


Fig. 3. This Ledeen cylinder operator has a separate piston rod provided for each cylinder.

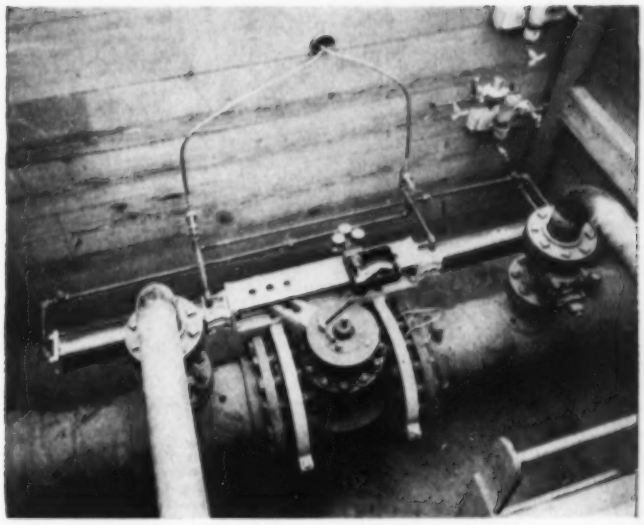


Fig. 4. One of the larger Ledeen double-acting cylinder assemblies installed on a valve in a pit.

sure-sensing element, a pilot control, and an additional source of energy. In the case of gas pipelines, properly sized accumulators and orifices provide not only the means for sensing rate of change of pressure, but also the primary power source.

Another important application is for safety shutoff valves, which might be used, for example, in automatically or remotely cutting a compressor station off the line in the event of a fire.

These operators would logically be powered from compressed gas in cylinders.

Some mechanical features that would be included in an ideal operator:

1. A means for providing a high momentary torque for initial turning of the valve. This condition is not too troublesome in the case of lubricated plug valves.

2. A means of limiting the torque output of the operator in the event of a stuck valve. This is to prevent mechanical damage to the operator and valve mechanism.

3. A means for limiting travel of the operator to maximum travel of the valve. A severe shock to the gearing and operating mechanism can result from overrunning of the operator.

4. It should be capable of being easily connected into various control circuits in common usage; and, especially, it should be simple to operate remotely. It should not creep.

5. A convenient, easy to use, manual means of operating the valve should be provided at the valve location.

6. Motor and handwheel should be capable of being declutched by a mechanism at the valve. This mechanism should automatically return the valve to a condition of standby for powered operation when the handwheel is not in use.

7. The handwheel should not rotate when the valve is being operated under power.

8. The operator should be capable of being readily installed in the field. This would apply to valve modernization, maintenance, or merely delayed installation on a new valve.

9. The need for service should be minimized, and the unit should be proofed against rain, dirt, freezing, etc.

10. The operator must be reasonable in cost.

The powered operators for lubricated plug valves are in two categories:

1. For smaller, low-pressure valves with the operating lever directly connected to the plug. This type is most readily powered with a linear motion from a hydraulic cylinder.

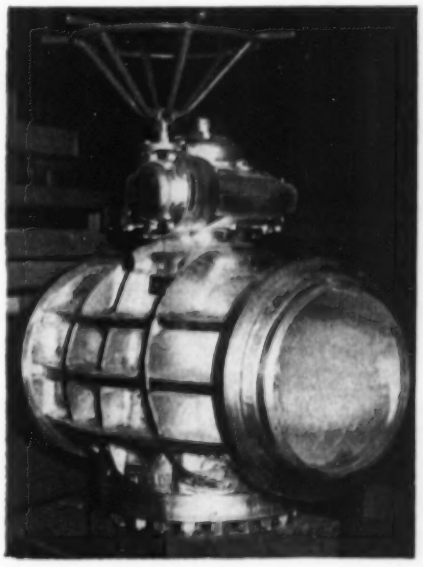


Fig. 5. A 30-in. Nordstrom lubricated plug valve, hand-wheel operated through a compound worm gearing.

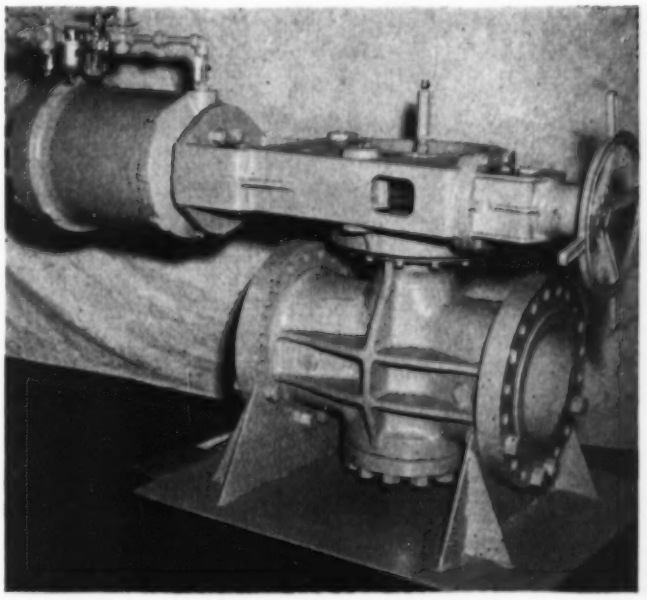


Fig. 6. Nordstrom plug valve equipped with a power cylinder.

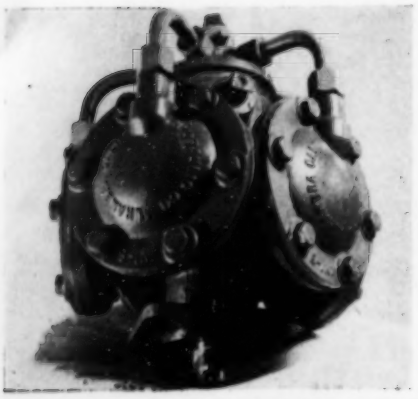


Fig. 7. A geared, plug-valve operator designed by Rockwell for PG&E.

2. For larger pipeline valves with a gear-driven plug. These usually are fitted with a motor, driving into the existing gear from an auxiliary gear box.

Smaller, low-pressure type

Fig. 1 shows a cylinder operator of a type manufactured by the Hanna Engineering Works. This is an example of the first valve-type category mentioned previously. These units have to be directly connected to the valve stem and are, therefore, not applicable to gear-operated valves. The equipment consists of a lever arm installed on the valve stem with a bracket clamped to the pipe adjacent to the valve. A piston rod is connected to the valve operating lever, and a hydraulic cylinder is connected to the pipe bracket. The piston rod is protected from the weather with a flexible rubber bellows. The cylinder can be operated by either liquid or gas. This installation is relatively compact and is usually used on manifolds for remote operation.

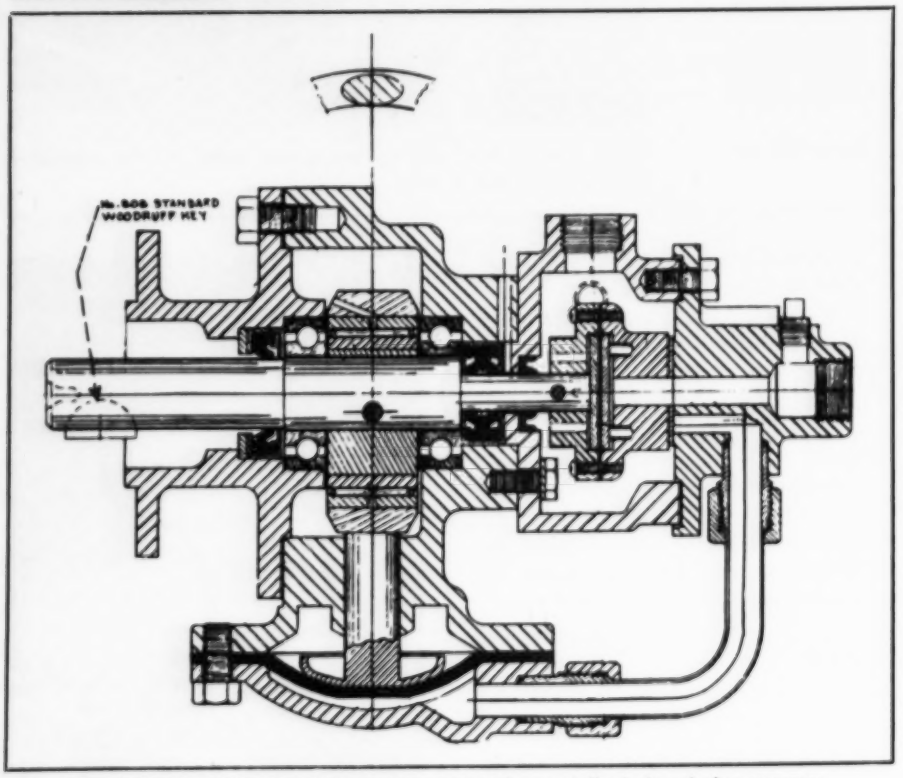


Fig. 8. Sectional drawing of the motor used in the specially designed plug operator.

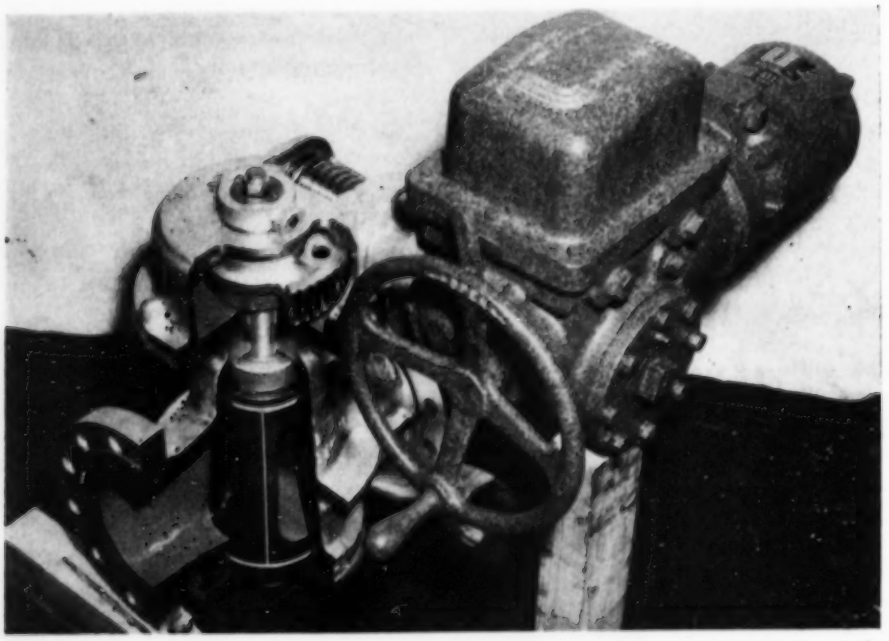


Fig. 9. The new SMA electric unit, equipped with an electrical limit switch compartment for torque limiting.

Fig. 2 and *Fig. 3* show Ledeen Manufacturing Co. cylinder operators.* These units feature opposed cylinders. The assemblies pictured show two methods of installing these operators on valves. The assembly shown on *Fig. 2* is equipped with solenoid valves for controlling the flow of air or gas to the cylinders, and has a single piston rod directly to the valve operating lever. *Fig. 3* shows a similar type of unit, but differing in that a separate piston rod is provided for each cylinder. These cylinders are used double acting. This arrangement is required for larger valves operating at higher pressures.

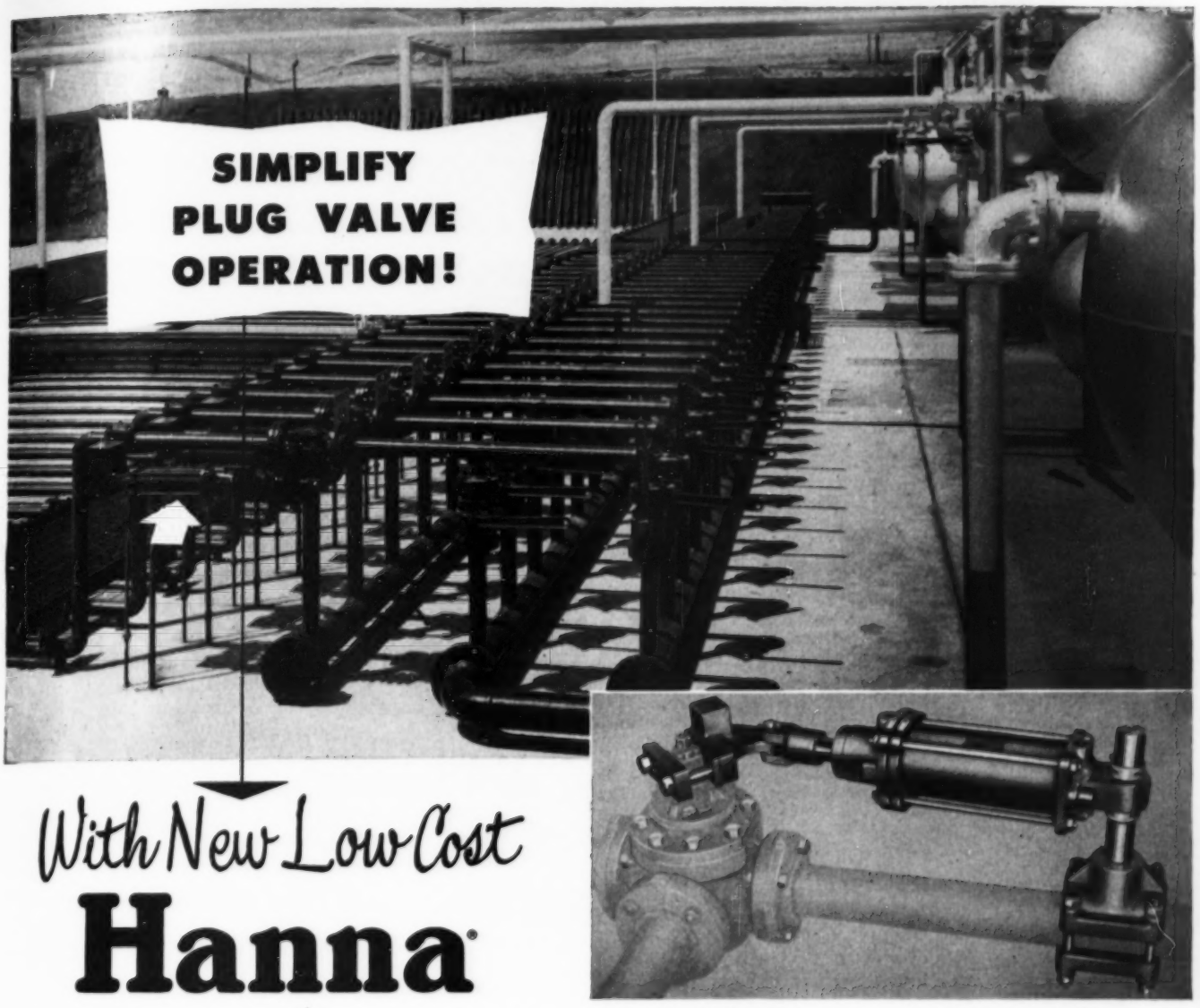
Fig. 4 shows one of the larger Ledeen, double-acting cylinder assemblies installed on a valve in a pit. The relatively simple flange mounting arrangement can be seen.

Gear-driven plug type

Fig. 5 is an example of the second valve-type category and shows a 30-in. Nordstrom lubricated plug valve, handwheel operated through compound worm gearing.

Fig. 6 shows a Nordstrom plug valve equipped with a power cylinder. The piston in this unit is directly connected to a toothed rack, which engages with a gear segment mounted directly on the valve stem. This cylinder unit is typical of equipment furnished by the Hannifin Corp., and installed at the factory when the valve is assembled. This operator is available in both non-automatic and automatic units. The non-automatic valve assembly is usually used for remote operation of a valve by compressed air, hydraulic fluid, or gas pressure. In the case of automatic valves, the operating fluid (which normally would be pipeline gas) is contained in storage accumulators, which,

*See "Tandem-Type Actuator Widens Applications of Automatic and Remote Valve Control," *GAS*, May 1954, page 152.



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The inset photo shows in bold outline the Hanna Valve Operator in a typical application.

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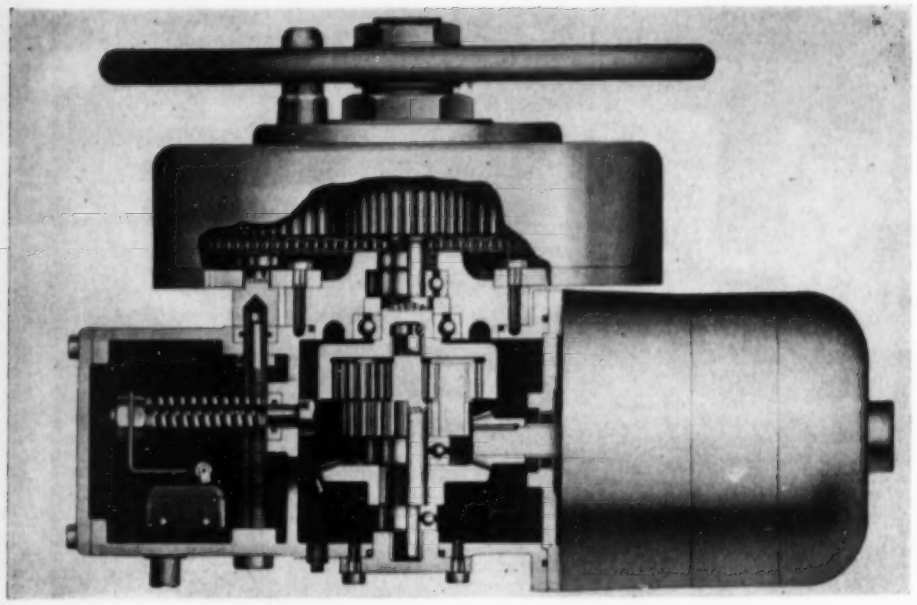


Fig. 10 (above). Cutaway view of Tork-Master electric operator.

Fig. 11 (below). A section taken through the handwheel shaft of the Tork-Master.

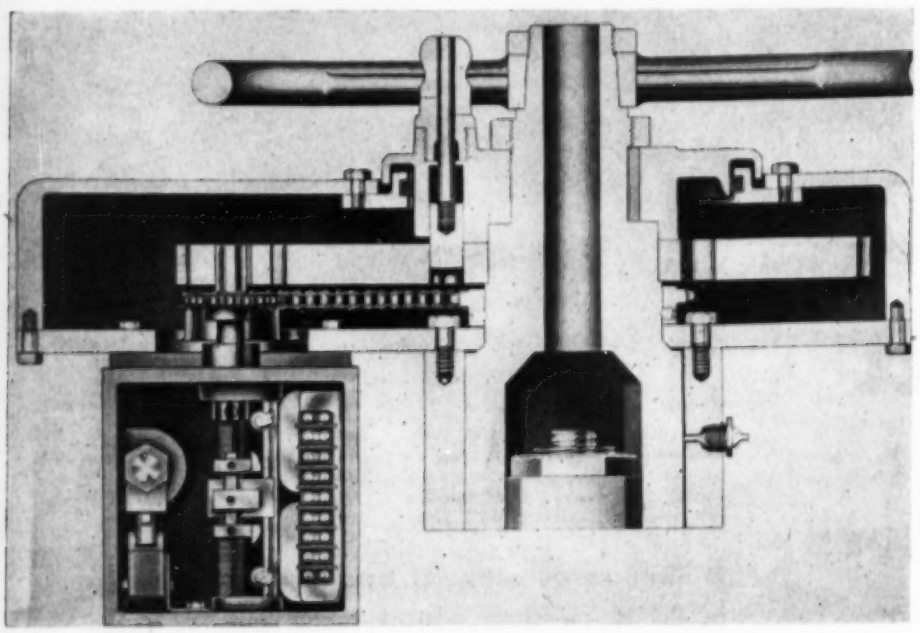
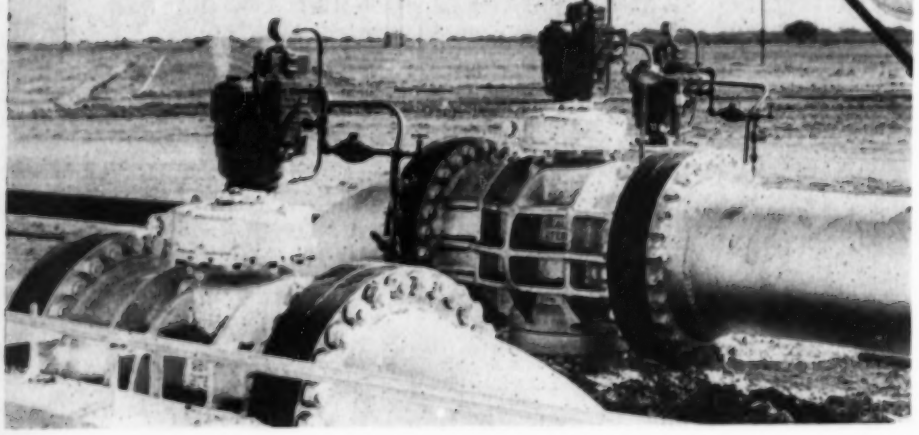


Fig. 12. E.I.M.'s operator, equipped with a solenoid-controlled gas motor.



through an orifice system, apply their pressure to the cylinder in such a manner that the resulting piston movement closes the valve in the event of a line break or other sudden change in pressure.

At the request of the Pacific Gas & Electric Co., the Rockwell Manufacturing Co. has designed a geared, plug-valve operator consisting of a motor manufactured by the Hydraulic Co. and an auxiliary gear box with manual motor declutching and manual handwheel declutching. *Fig. 7* shows the motor, which is a five-cylinder diaphragm unit with a rotary valve, and *Fig. 8* shows a sectional drawing of the motor. Note that the diaphragm isolates operating gas from the interior of the motor. The rotary valve is directly fastened to the end of the motor shaft. This connects the cylinders to intake and exhaust systems in the proper sequence. No torque or position limiting controls are provided with this installation other than plug stem stops.

The Limitorque operator, manufactured by the Philadelphia Gear Works, can be equipped with either a pneumatic motor or an electric motor.

Fig. 9 shows the new SMA electric unit. It is equipped with an electrical limit switch compartment for torque limiting. These various switches limit travel of the valve, and torque developed by the unit, by stopping the motor as required.

The Limitorque has an automatic arrangement for declutching the auxiliary handwheel, shown in the illustration, from the driving mechanism whenever the motor is energized. Handwheel operation is provided by proper manipulation of the toggle assembly, which can be seen just opposite the end of the motor shaft. Alternative engagement is provided between the handwheel bevel gear and the two crown bevel gears above and below it. With this arrangement, the handwheel is stationary when the motor is turning the valve.

Fig. 10 is a cutaway view of the Tork-Master electric operator manufactured by the Tork-Master Div. of Harvill Corp. Tork-Master valve operators are available in a variety of models with electric, hydraulic, and pneumatic motors. The unit pictured consists of an electric motor, a gear box, and a series of limit and torque switches.

The motor, on the right, drives from the bevel gear to a second bevel gear mounted on a vertical shaft. This vertical shaft carries a planetary gearing

system which drives a pinion gear at the top of the unit. This pinion drives a large gear which carries a handwheel, and which, in turn, connects directly at its base with a handwheel shaft on a geared plug valve. The limit switch assembly is driven by the light chain shown near the top of the unit; the limit switches are in a compartment on the lower left side of the assembly. The microswitch, shown in the bottom left-hand corner is a torque limiting switch and is actuated by the anchor arm of the planetary gear arrangement. This anchor arm is spring loaded, and, by proper adjustment of the spring, the proper torque can be set.

Fig. 11 shows a section taken through the handwheel shaft of the unit. The limit switch compartment is shown at the bottom left-hand corner, and the large gear is seen in section round the handwheel stem. Just to the left of the top of the handwheel stem can be seen the plunger, which connects the large gear to the handwheel shaft. Pulling up this plunger isolates the powered section of the operator and permits the valve to be turned, using the handwheel alone. This type of mechanism requires the handwheel to rotate whenever the powered operator is in action.

Gas motor actuation

One of the operators, manufactured by the E. I. M. Co., is equipped with a solenoid-controlled gas motor, which drives a gear box mounted directly on the handwheel shaft of the plug valve gearing. A typical installation is shown in *Fig. 12*, and a close-up in *Fig. 13*.

The gear train used for driving the gas control valves takes the place of a limit switch compartment as applied to electrically power operators. These control valves are connected to the motor gas supply and limit the plug valve position, as required.

The Shafer operator fits onto the top of the valve in place of the normal gear housing. A typical installation of a Shafer hydraulic valve-operator, on a 30-in. Nordstrom valve, is shown in *Fig. 14*. The two cylinders, on the side of the operator, are separating tanks to keep the fluid, which operates the hydraulic unit, from mixing with the line fluid.

Fig. 15 shows a line diagram of the hydraulic system as applied with one of the simpler control circuits that have been designed. Note the two separating tanks on each side of the operator proper. Manipulation of the hand valve allows mainline gas pressure to be connected to the right-hand separating tank. The top of the left-hand separating tank is connected to the atmosphere. Under these conditions, the hydraulic fluid is forced into the two chambers of the operator.

Valve operators... Application of torque to valve stem is made without any side-thrust

The hydraulic line is shown connected directly to one chamber, while an internal port connects the fluid pressure to the other half of the operating vane. Since the two opposite chambers are at atmospheric pressure, through the left-hand separating tank, the vane is caused to move in an counter-clockwise direction. The movement continues until the operator has travelled a full 90° and the small valve has closed the discharge opening.

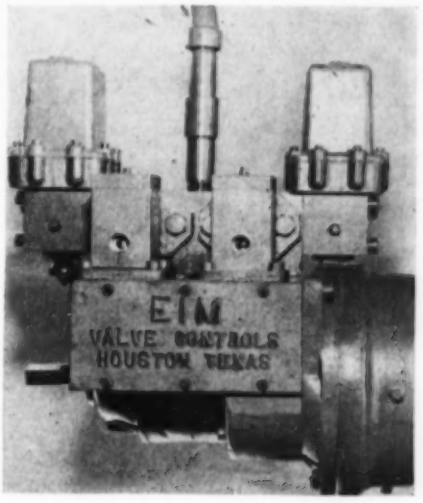


Fig. 13. Close-up of a typical installation of an E.I.M. operator.

Reversing connections

A clockwise motion of the operator vane is produced by reversing the connections to the two separating tanks. The right hand tank then being connected to the atmosphere and the left hand tank being connected to the gas line pressure.

One of the important features of this unit is the fact that the application of torque to the valve stem is made without any sidethrust. This is the result of the balanced arrangement of the hydraulic fluid pushing against the two ends of the moving vane, on opposite sides. The splined hole in the center of the unit connects directly with the valve stem of the plug valve. ■

Fig. 14. Typical installation of a Shafer operator on a 30-in. Nordstrom valve.

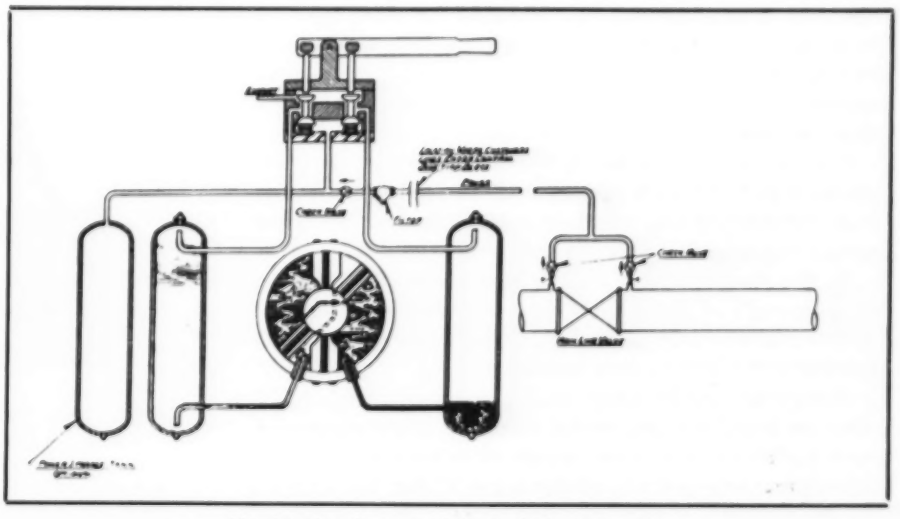


Fig. 15. Line diagram of Shafer hydraulic system.

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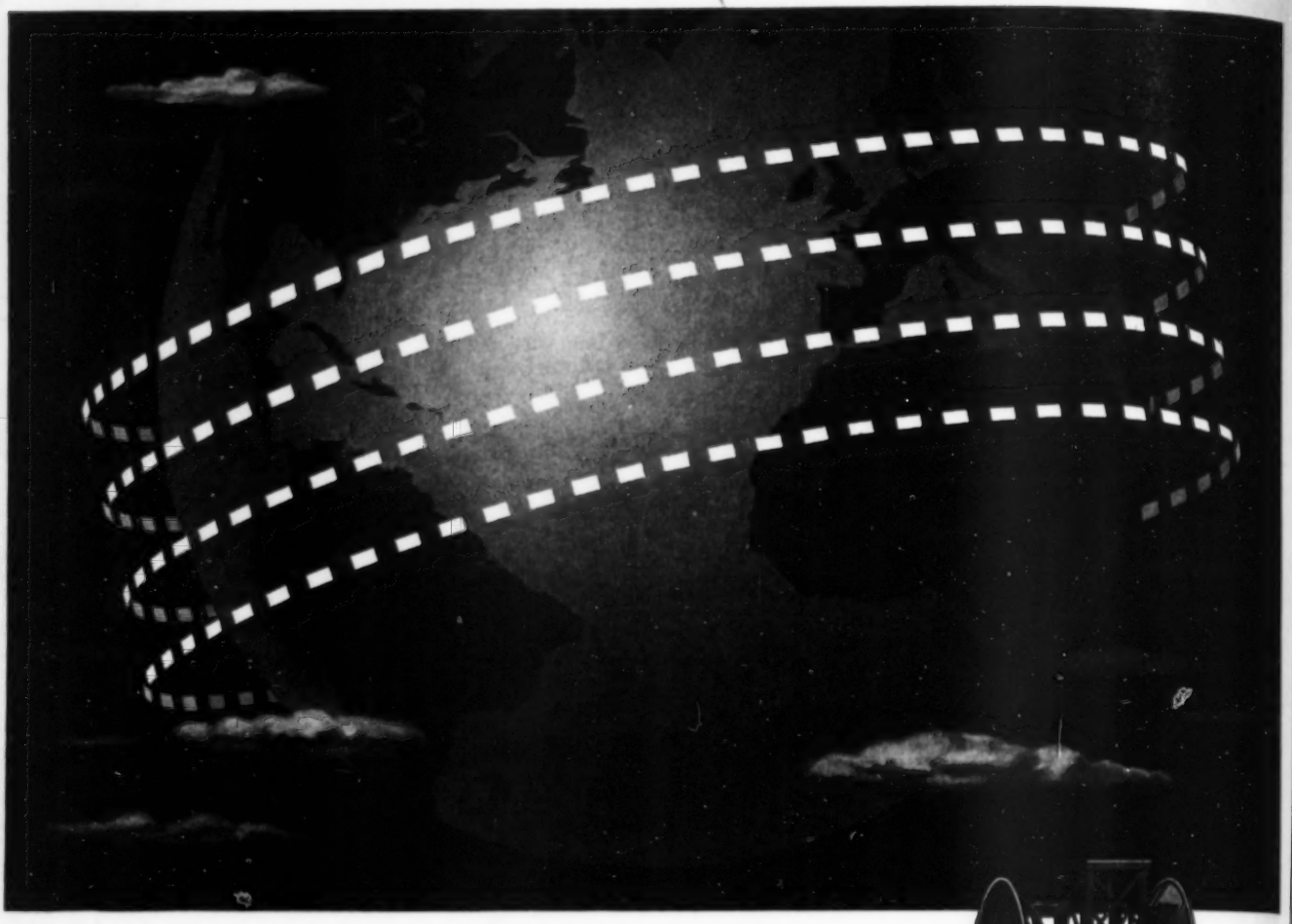

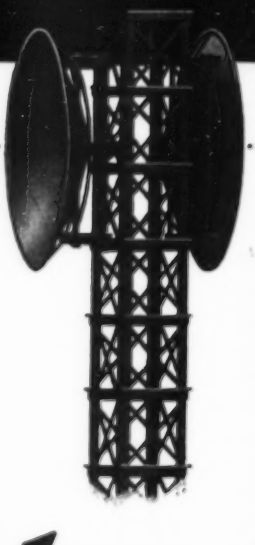

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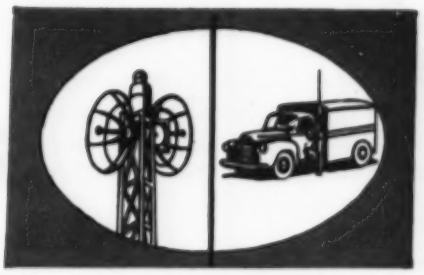


By FRANK CHAPMAN

Field communication systems are integrated plant facility

SUCCESSFUL operating experience with one of the country's oldest and longest microwave systems was described by C. E. Upson, superintendent of communications for Texas Illinois Natural Gas Pipeline Co., at the recent AGA transmission conference in Pittsburgh. The Texas Illinois microwave system, put into operation in January 1952, has a present combined total of 1090 route miles in operation, with facilities equipped to provide 7300 channel miles of voice communication. The system makes use of 12-channel equipment with a total capacity of 13,080 channel miles of voice circuit, which, with the replacement of certain channelizing and terminal equipment, at a cost of about 12% of the original investment, could be increased to 24 channels or double the current potential.

For his discussion, Mr. Upson called upon the experience of two other companies, Natural Gas Pipeline Co. of America and Natural Gas Storage Co. of Illinois, both of which are operated under the direction of the same management and operating supervision as Texas Illinois.

98% reliability

"The reliability of the Texas Illinois system," according to Mr. Upson, "on a 24-hour basis is over 98%. This compares to a reliability of 97.5% for the mainline wire facilities of Natural Gas Pipeline Co., both systems being approximately 1100 miles in length." The system operates in the 6575-6875 mc band. Each station in the system is equipped with full duplicate standby transmitter and receivers, control equipment and power supplies. The equipment is automatic in operation and, in the event of failure of a main transmitter, receiver or power supply, the equipment will automatically switch to the standby equipment.

In commenting upon the present day application of microwave service to a gas pipeline, Mr. Upson pointed out that, "most gas companies have become dependent upon their field communication systems to the extent that these systems are considered an integrated plant facility, as vital to the various phases of the gas industry operation as our compressor stations and pipelines." He emphasized that speed in handling production and gas dispatching orders, in reporting and advising those concerned of emergency conditions, and in dispatching men and equipment in connection with pipeline repair work is an important factor in assuring an uninterrupted supply of natural gas to the company's customers.

Current services

In detailing the company's communication facilities he listed the following services that are currently provided:

1. A dial party line channel providing direct communication for pressure dispatching and compressor station operational traffic to and between Chicago and each of the 11 field compressor stations. Service on this channel is installed in the offices and extended to telephones in the main engine rooms for direct communication with operating personnel on duty around the clock.

2. A dial party line channel used primarily for traffic in connection with pipeline operation and maintenance. This channel provides service to and between Chicago and the offices of the pipeline department field supervisory personnel at compressor stations. In addition, this channel is extended into the pipeline supervisor's residence at the compressor stations to avoid delay in contacting key personnel at night or on weekends when field offices are closed.

3. A third dial party line channel used primarily for VHF radio relay. This channel provides normal communication from Chicago to and between the 11 compressor stations and Joliet meter station. However, it is arranged so that any car, truck or aircraft, working along the route of the pipeline, which is equipped with a VHF two-way mobile radio can be connected to this microwave channel at a compressor station for communication to any other office on the system, or to another radio-equipped vehicle at any point on the system. This is an extremely flexible and valuable service. During pipeline shut-outs or major repair work, for example, the dispatchers have continuous knowledge of conditions prevailing at the location where work is being performed through direct contact with personnel on the job. Field supervisors may be contacted when away from headquarters by anyone on the system having urgent business with them. Personnel traveling in company aircraft or automobiles may be contacted direct by their office while en route.

Inter-station

4. A fourth dial party line channel is arranged for inter-station communication between field operating headquarters at Malvern, Ark., approximate midpoint on the system, and each compressor station between Malvern and Hungerford, Texas, and between Malvern and Hammond, Ill., the northern-

most compressor station on the system. Division of this channel permits utilization of both sections of the channel simultaneously for traffic between field supervisory personnel.

5. There are three channels which provide "private line" service. These are between Chicago and the production offices in Houston; Chicago to field maintenance headquarters at Malvern, Ark., and Chicago to the meter station and laboratory offices at Joliet, Ill.

6. In addition to the above, three channels of the Texas Illinois microwave system are jointly used by Natural Gas Pipeline Co. to extend Natural's company-owned wire lines from Aurora, Ill., into the Chicago offices.

Microwave channels

In addition, the point-to-point communication facilities of Natural Gas Storage Co. consist of two microwave channels between Chicago and the company's plant near Herscher, Ill., and a meter station at Joliet. This system also utilizes spare channels of Texas Illinois to an unattended repeater station near Cabery, Ill., from which point it is extended to Herscher with a microwave stub.

The company's communication facilities are further rounded out with VHF radio base stations and two-way mobile units. These facilities total 27 base stations and 220 mobile units in operation at the present time. Five of the mobile units are in aircraft.

With this extensive microwave experience as background, Mr. Upson predicted that this "relatively new art of radio communication will provide greater reliability, a wider range of application to our needs, and a greater economy in the future than most of us would have thought possible a few years ago."

Central Committee files comments on 20 kc. separation

The Central Committee on Radio Facilities of the API has filed its comments with the FCC on proceedings to amend parts of the commission's rules to reduce separation between assignable frequencies in the 25-50-mc and 152-162-mc bands. The comments referred to the Central Committee petition which had been filed on March 15, 1954, requesting substitution of 20 kilocycle separation for the present 40 kilocycle separation in the Petroleum Radio Service. The comments pointed out that the tests which had been conducted prior to that petition, designed to prove the practicability of 20 kilocycle separation, are equally valid at this time to indicate the advisability of splitting the channels in the 25-50-mc band.

Regarding the proposal to reduce separations in the 152-162-mc band, the Central Committee comments stated that the viewpoint of the committee was based principally upon practical theoretical considerations and general knowledge of the technical characteristics of modern equipment in this band. These considerations indicate that channel splitting in the 152-162-mc band is practicable, and the Central Committee favors that proposal which would list assignable frequencies on a 15 kilocycle basis, thereby providing for 30 kilocycle separation.

Philco announces new division

Philco Corp. recently announced the formation of a new division, to be known as the Lansdale Tube and Transistor Co., for the manufacture and sale of a wide range of cathode ray tubes, vacuum tubes, transistors, diodes and other semi-conductor devices.

The new division, with its main plant at Lansdale, Pa., has been a Philco subsidiary since 1947 and is a major supplier of tubes and transistors to both government and industry. The new company will be headed by William J. Peltz as vice president and general manager, according to James H. Carmine, Philco's president.

Recent FCC allocations

Hope Natural Gas Co. for one base station at Wilbur, W. Va., on 48.70 mc.

Transcontinental Gas Pipeline Corp. for four base stations near Gills, La., and along and adjacent to company pipeline from Virginia-South Carolina border to Mississippi-Alabama border 48.74 mc.

Trunkline Gas Co. for one base station at Victoria, Texas, on 49.02 mc.

United Natural Gas Co. for one base station at Madix Run, Pa., on 48.98 mc.

Hope Natural Gas Co. for two base stations at Fink, W. Va., and at Queen Shoals, W. Va., on 48.70 mc.

Nevada Natural Gas Pipeline Co. for one base station at Las Vegas, Nev., and 40 mobile units on 48.62 mc.

United Natural Gas Co. for one base station at temporary locations in Philadelphia and New York on 48.98 mc.

GAS progress reports

NEW CONSTRUCTION PLANNED

CITIES SERVICE GAS CO., Oklahoma City. To construct 4- to 20-in. 93-mile line between Blackwell, Okla. and Independence, Kan.; 145-mile gathering system in Barber county, Kan. and Woods county, Okla.; and 2700-hp compressor station near Alva, Okla.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh. Docket G-8568 for 21 miles of line paralleling section of line in Wyoming and Livingston counties, N.Y. to complete looping of line from Potter county, Pa. to near Caledonia, N.Y.

SOUTHERN CALIFORNIA and SOUTHERN COUNTIES GAS CO.'s, Los Angeles. To build 278 miles of 30-in. line from Topock to Alhambra, Calif. and 10,500-hp compressor station at Topock to bring an additional 225 MMcf/day into southern California from San Juan basin via El Paso Natural's system.

TRUNKLINE GAS CO., Houston. Docket G-8664 and G-8665 for eight new compressor stations in Texas, Louisiana, Mississippi, Tennessee, and Illinois totaling 56,000 hp; and 24 miles of line paralleling existing system in Texas.

CURRENT CONSTRUCTION

ARKANSAS LOUISIANA GAS CO., Shreveport. Docket G-2307 for 134 miles of 6⅝- to 24-in. line in 11 sections, and 10,500-hp compressor station on its system in Arkansas, Louisiana, and Texas. Compressor station and 71 miles of line completed.

ATLANTIC SEABOARD CORP., Charleston, W. Va. Docket G-6500 for 84-mile, 26-in. line paralleling Cobb (W. Va.)-Baltimore (Md.) line in West Virginia, Virginia, and Maryland, and 2000 additional hp at Cleveland station in Upshur county, W. Va. Williams-Austin Co. working on 31 miles in Brafton, Upshur and Randolph counties, W. Va.

COLORADO INTERSTATE GAS CO., Colorado Springs. Docket G-2121 - (1955 program) 385 miles of 22-in. line from Denver to connection with proposed Pacific Northwest Pipeline Corp. line at Green River, Wyo.; with 4400-hp compressor station near Green River. Houston Contracting Co. began construction June 15; 135 miles of 22-in. to be completed this year; remainder in 1956.

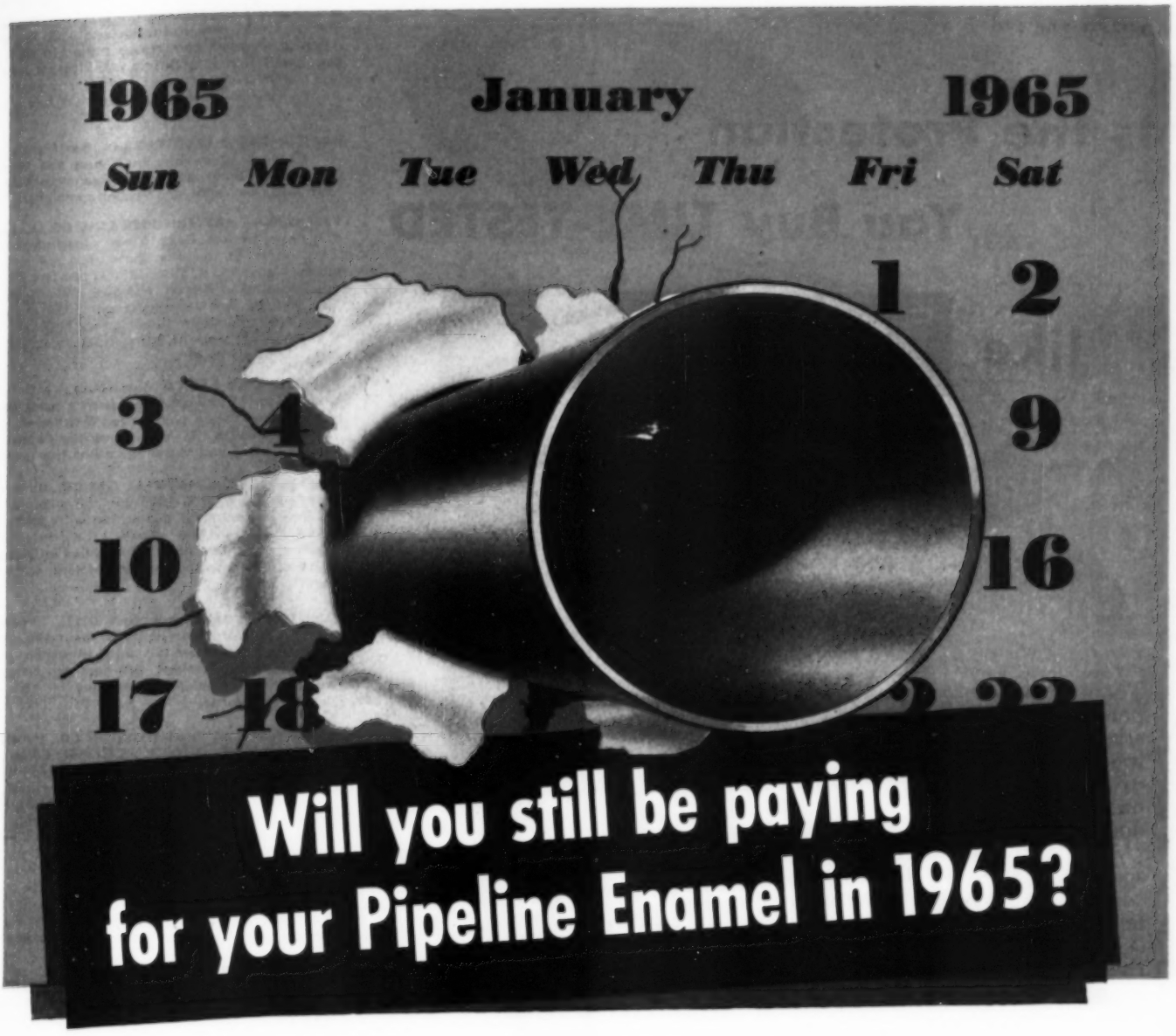
EAST OHIO GAS CO., Cleveland. A 113-mile, 30-in. pipeline to serve Cleveland area from point just south of Toledo. Construction started April 15. Completion date: Oct. 1.

EL PASO (TEXAS) NATURAL GAS CO. Docket G-2106 and G-2462 for 74 miles of line and 6925 additional hp on system in Texas, New Mexico, and Arizona. Should be completed by July 1.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh. Docket G-2193 for 72 miles of 20- and 16-in. line, 38.7 miles of storage and well lines, 2 measuring stations and a 1760-hp compressor station at the Victory storage field in Marshall and Wetzel counties, W. Va.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh. Docket G-2289 for construction of 75½ miles of 10-, 12-, 24-, and 26-in. lines and 4400 in new and additional compressor facilities in Washington, Allegheny, Chester, Lancaster, and Adams counties, Pa., and Marshall county, W. Va.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh. Docket G-2479 for 61 miles of line and 1760 hp in compressor capacity on its system in Ohio, Pennsylvania, and West Virginia.



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MICHIGAN GAS STORAGE CO., Jackson. Docket G-6501 for 36-mile 16-in. line and 3300 hp addition at Freedom compressor station in Michigan. Line would extend from Mt. Pleasant Junction to Milwaukee Junction. Work on compressor started May 16. Bechtel Corp. to start July 1 on line.

PACIFIC GAS & ELECTRIC CO., San Francisco. An 18-mile, 12-in. line in Colusa and Glenn counties to bring gas into Sacramento valley from two new fields. September completion.

PANHANDLE EASTERN PIPE LINE CO., Kansas City, Mo. Docket G-2433 for construction of 294.5 miles of mainline loops, 106.3 miles of lateral loops, and 4750 additional hp. The 294.5 miles located in Kansas, Missouri, Illinois, Indiana, and Ohio were constructed in 1954 and are being operated under a temporary FPC permit. Remainder of work is being held in abeyance until approved by FPC.

SHENANDOAH GAS CO., Lynchburg, Va. Docket G-1448 for 39 miles of line from a point near Middletown, Va. to points near Winchester, Va. and Martinsburg, W. Va. Somerville Construction Co. scheduled to complete line this month.

SOUTH GEORGIA NATURAL GAS CO., Birmingham, Ala. Docket G-1915 for 368-mile, 12¾-in. line beginning at connection with Southern Natural line in Lee county, Ala., extending southeast to serve new communities in Georgia and Florida. Expected completion date: September 1955.

SOUTHEAST ALABAMA GAS DIST., Birmingham. A "U" shaped system of about 330 miles to serve 24 communities in southeastern Alabama from connections with Southern Natural. About 80% completed. Scheduled for completion in September.

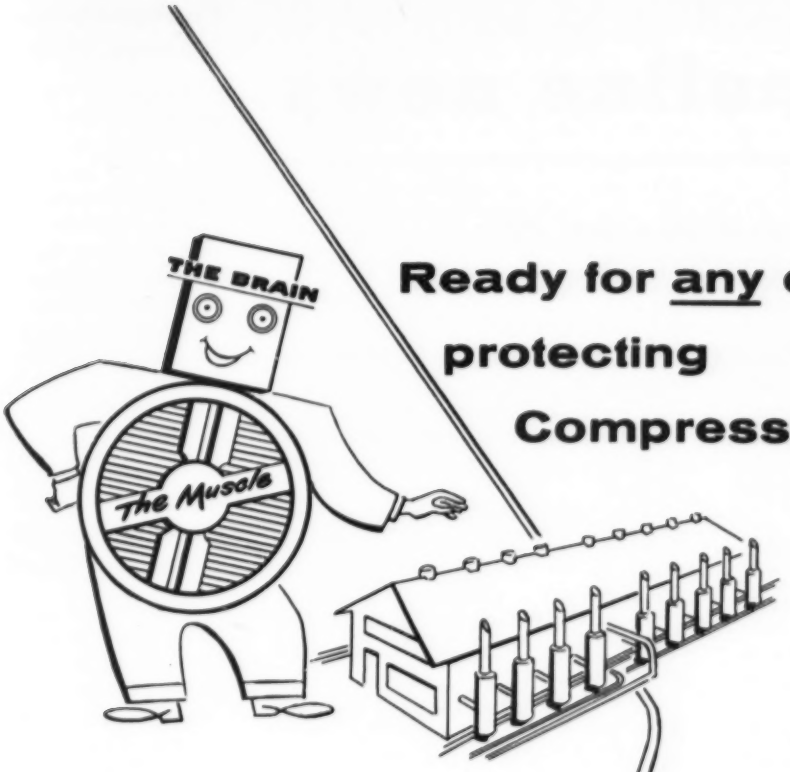
TENNESSEE GAS TRANSMISSION CO., Houston. Dockets G-2310, G-2330 and G-2331. Construction has begun in Pennsylvania on a 243- mile, 24-in. line from Hebron (Pa.) storage field to Greenwich, Conn., and on an 18-mile 24-in. Hebron to Harrison storage field plus 62 miles of 26-in. loop in Ohio. Development of two more storage fields—Colden near Buffalo; Harrison, in Potter county, Pa. Construction is underway at Isola, Miss., and at Morhead, Ky. on new compressor stations. Later this year company will construct 370-mile, 30-in. line from Agua Dulce, Texas, to Kinder, La., along Texas and Louisiana Gulf Coast line (Docket G-8215).

TEXAS EASTERN TRANSMISSION CORP., Shreveport, and **NEW YORK STATE NATURAL GAS CORP.**, Pittsburgh. Docket G-2784 to construct field pipelines to connect up additional wells in Murrysville pool; acquire 2000-hp field gathering compressor station; and install 1980-hp station. New York State will operate facilities.

TEXAS GAS TRANSMISSION CORP., Owensboro, Ky. Docket G-6854 to lay 77.14 miles of partial loops in 7 sections between Covington, Tenn. to Jeffersontown, Ky.; 74 miles, 12-in., 35 miles 10-in., and 5 miles, 8-in. between Hardinsburg, Ky. compressor station and Columbus and Bedford, Ind.; to construct 26-in. crossings of Tennessee and Cumberland rivers in Kentucky and dual 12-in. crossings of Ohio river near Hardinsburg, Ky.; to build 4500-hp station at Columbia, La., and to add 4000 hp at Greenville and Clarksburg, Miss.; 2000 hp at Lake Cormorant, Miss., and 1500 hp at Covington, Tenn. H. C. Price Co. to lay 26-, 12-, 10-, and 8-in. lines (except river crossings); Houston Contracting Co. to lay 20-in.; Pentzein Inc. to lay Cumberland, Tennessee and Ohio river crossings.

CONTRACTS LET

PACIFIC NORTHWEST PIPELINE CORP., Houston. Docket G-1429 for 1466 miles mainline; 380 miles of spur and lateral lines; and 16 compressor stations totaling 104,420 hp, to extend from Ignacio, Colo., in the San Juan basin, to Bellingham, Wash. (Seattle area). Fish Northwest Constructors Inc., builders of the line, have let contracts to River Construction Corp., R. H. Fulton & Co., Associated Pipeline Contractors, A. J. Curtis Construction Co., B. & M. Construction Co., Midwestern Constructors Inc., for first 655 miles.



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GAS pipeline news

Natural Gas Act amendment plan gets by first hurdle with 16-15 approval vote

First major hurdle in the path of amending the Natural Gas Act to clarify the position of producers was barely skimmed last month when the House Interstate and Foreign Commerce Committee gave a narrow 16-15 approval to H.R. 6645, the revised bill of Rep. Oren Harris, Arkansas Democrat.

At presstime, there was no further progress to report. A final vote in the Senate Interstate Committee was expected momentarily, and there was some optimism evident among proponents of the parallel Fulbright bill as to its chances of the floor; however, a close fight was anticipated in the House in view of the closeness of the committee decision, and all the mastery of Speaker Sam Rayburn was expected to be required to pull the Harris bill through to victory.

As reported out, the bill contained several alterations to the original Harris bill, H.R. 4560. As amended, the bill among other things gives FPC authority to review escalation clauses in existing contracts, brings producers under the no-abandonment requirement, and permits pipeline-producer companies to value their gas at the reasonable market price.

The bill almost died in committee. At one point the body was hung at 14-14, which would have meant expiration for this term had not an agreement been reached for a new vote, with three members who were absent in the original vote participating.

Conflicting bills were given the heave-ho in the waning days of the committee's deliberations, including the Macdonald Heselton bill to exempt the small producers but retain Phillips-type control over the big boys, and the Wolverton bill, which was the chosen instrument of the eastern distributing utilities as represented by the testimony of Randall Le Boeuf Jr.

Full text of the Harris bill appears on the facing page.

Statements of the persons involved revealed clearly that they were not entirely happy with the outcome. Chairman Priest gave the impression that he regretted the lack of unanimity of thinking by committee members, and that he was not completely enthusiastic over the bill as voted out—but that something needed to be done and this was the best that could be had.

Oren Harris, the author, displayed his feelings by introducing on the House floor a resolution calling for a probe of the cost of transmission and distribution of natural gas in interstate commerce. He said:

"It is quite obvious to me, as illustrated by the closeness of the vote by which the bill was reported, that before this situation is cleared up in the interest of the industry as well as the consumer, other factors are going to have to be considered.

". . . It is agreed by most everyone that (production and gathering, and its sale in the field) cannot be treated as a utility and regulated as such in the interest of the public. However, in the course of the hearings, the committee developed facts that led it to the conclusion that in the interest of the consumer there must be federal regulation of prices which the consumer would pay, of not only future contracts, but of existing contracts between pipelines and producers. The committee provided . . . authority for such regulation.

"Even so, this apparently is not sufficient from the viewpoint of a great many people."

Mr. Harris proposed that the probe look into the "90% of the price the consumer pays" that is added on after the producer sells to the pipeline company.

"I think we should find out why it is that in New York the average cost to the residential consumer is $2.43 per Mcf for natural gas that has a field price of 8 cents," he declared. He also cited numerous other examples of comparable price structures.

"What is responsible for it?" he asked. "Is it because of interlocking relationship among various companies? Is it because of certain types of management and operation? Is it because of holding company operations? Is it because one affiliate of a company is selling to another, then another, before it ever gets to the consumer?

"De we actually have effective regulation in the interest of the consumer by the public service commissions?

"The chairman of the Federal Power Commission stated before our committee that there should be an investigation into the interlocking directorship or relationship among these big companies."

Panhandle confronted by leakage at Waverly field

Panhandle Eastern Pipe Line Co.'s proposed underground gas storage field at Waverly, Ill., probably won't be used this winter because of leakage difficulties, the company has told the FPC.

The Waverly field, part of Panhandle's proposed $66.8 million expansion program, was designed to boost the company's daily delivery capacity by 2 MMcf, which would be used by some 50 of Panhandle's customers in Ohio, Michigan, and Kansas. Company officials say that they are working on a substitute plan by which they hope to supply customers with much of the gas that would have been stored at Waverly.

First shipment of pipe rolls for Pacific Northwest

The first shipment of pipe destined to become part of the Pacific Northwest Pipeline Corp.'s "initial pipeline system" rolled out of the U. S. Steel's Consolidated Western Steel division Provo plant during the first week in June. In ceremonies, R. D. Ricketts, president of Fish Northwest Constructors, designers and builders of the line, and Charles W. Lee, vice president of Consolidated Western, coupled a locomotive to a 100-car train loaded with the 26-in. line pipe and officially started it on its way to the Fish Northwest crews on the southern end of the line. The pipeline system will be constructed from Ignacio, Colo., in the San Juan basin, to Bellingham, Wash., near the Canadian border, when the project is finally completed.

Nine hundred miles of right-of-way have been permitted for surveying and 400 miles have been staked out by 14 engineering survey crews in the field for Pacific Northwest. A full complement of right-of-way and land acquisition teams is accompanying the crews. The aerial survey for the entire 1466-mile line has been 95% completed; this includes work on the mainline, gathering lines and sales laterals. On the gas supply side, 117 wells have been completed, seven are drilling away, and 127 additional locations have been approved for drilling.

Contracts have been let for 655 miles of line that will cost $11 million and will provide for construction of the mainline from Ignacio to about Burley, Idaho. Participating contractors will be: River Construction Corp., Ft. Worth; R. H. Fulton & Co., Lubbock; Associated Pipe Line Contractors Inc., Houston; A. J. Curtis Construction Co., Casper; B & M Construction Corp., Oklahoma City; and Midwestern Contractors Inc., Tulsa. They will build the first eight schedules; schedules 3 and 4, representing a section extending from

Text of the Harris Bill to amend the Natural Gas Act

Be it enacted, etc., That paragraph (7) of section 2 of the Natural Gas Act, as amended, is amended to read as follows:

"(7) 'Interstate commerce' means commerce between any point in a state and any point outside thereof, or between points within the same state but through any place outside thereof, or between any point in a state and any foreign nation, but only insofar as such commerce takes place within the United States."

SEC. 2. Section 2 of the Natural Gas Act, as amended, is amended by adding at the end thereof the following two new paragraphs:

"(10) 'Transportation of natural gas in interstate commerce' means only such transportation of natural gas in interstate commerce as occurs after the completion in or within the vicinity of the field or fields where produced of all production, gathering, processing, treating, compressing and delivering of such natural gas into the transportation facilities of a person engaged in transporting, in such transportation facilities, natural gas in interstate commerce beyond the vicinity of the field or fields where produced.

"(11) 'Sale in interstate commerce of natural gas for resale' means only such sale in interstate commerce of natural gas for resale as occurs after the commencement of the transportation of such natural gas in interstate commerce as defined in paragraph (10), but does not include any sale which occurs in or within the vicinity of the field or fields where produced at or prior to the commencement of such transportation in interstate commerce of the natural gas."

SEC. 3. Subsection (b) of section 5 of the Natural Gas Act, as amended, is hereby redesignated as subsection (h), and such section 5 is further amended by inserting immediately after subsection (a) thereof the following new subsections:

"(b) When an increase in any rate or charge for natural gas is filed with the commission by a natural-gas company and based in whole or in part upon any contract, executed or renegotiated after the date this subsection takes effect, for the purchase of natural gas from a person other than an affiliate, the commission shall determine, unless there has been a prior determination under subsection (c) of this section, whether the price at which the natural-gas company has contracted to buy such natural gas is the reasonable market price thereof at the point at which the gas is delivered into the transportation facilities of the natural-gas company in or within the vicinity of the field or fields where produced. After such determination, the natural-gas company shall be allowed to charge as an operating expense for natural gas purchased under the contract only such part of the contract price as does not exceed such reasonable market price. In determining the reasonable market price of natural gas under the provisions of this section 5, the commission shall consider, among other things, whether such price has been competitively arrived at, the effect of the contract upon the assurance of supply, and the reasonableness of the provisions of the contract as they relate to existing or future prices.

"(c) The commission shall determine upon application by a natural-gas company, or may determine upon the commission's own motion, after notice and opportunity for hearing, whether the price to be paid for natural gas under the provisions of any contract executed or renegotiated after the date this subsection takes effect is the reasonable market price thereof at the point at which the gas is to be delivered into the transportation facilities of the natural-gas company in or within the vicinity of the field or fields where produced. After such determination, the natural-gas company shall be allowed to charge as an operating expense for natural gas purchased under the contract, for the purposes of rates or charges thereafter filed by it under this Act, only such part of the contract price as does not exceed such reasonable market price.

"(d) When an increase in any rate or charge for natural gas, filed with the commission by a natural-gas company after the date this subsection takes effect, is based in whole or in part on an increase in price under the provisions of an escalation clause in any contract, other than a contract to which subsection (b) applies, for the purchase of natural gas from a person other than an affiliate, the commission shall determine whether the price as so increased is the reasonable market price of the natural gas at the point at which the gas is delivered into the transportation facilities of the natural-gas company in or within the vicinity of the field or fields where produced. When the commission has made such determination, the natural-gas company may charge as an operating expense for natural gas purchased under the contract only such part of the increase in price as results in a price which does not exceed such reasonable market price. As used in this section 5, the term 'escalation clause' means any provision in a contract for the purchase of natural gas the operation of which may result in an increase in the price of the natural gas sold under the contract, but such term does not include (1) any provision for increases, by specific amounts, in the price of the natural gas at definite dates in the future, or (2) any provision under which the natural-gas company agrees to reimburse the seller of the gas for any increase in taxes which may be levied upon such seller after a specified date.

"(e) Whenever, in connection with an increase in the price of natural gas under the provisions of an escalation clause, the commission, pursuant to subsection (d), has made a determination as to the reasonable market price of such natural gas, the natural-gas company shall be obligated to pay only such part of the increase in price as results in a price which does not exceed such reasonable market price; and, except as otherwise provided in this subsection, the contract containing such escalation clause shall continue in effect according to its terms as though this subsection had not been enacted.

"(f) In regulating the rates and charges of a natural-gas company, the commission shall allow as an operating expense of such natural-gas company, for natural gas produced by it, the reasonable market price of such natural gas at the point at which the gas is delivered into the transportation facilities of the natural-gas company in or within the vicinity of the field or fields where produced, and for gas purchased from an affiliate, the amount paid to such affiliate for such gas up to but not in excess of the reasonable market price of such natural gas at the point at which the gas is delivered into the transportation facilities of the natural-gas company in or within the vicinity of the field or fields where produced.

"(g) For the purpose of this section 5, a person shall be held to be an affiliate of a natural-gas company if such person controls, is controlled by, or is under common control with, such natural-gas company."

SEC. 4. Subsection (e) of section 7 of the Natural Gas Act, as amended, is amended by adding at the end thereof the following new sentence: "Notwithstanding the foregoing provisions of this subsection, in passing upon an application for a certificate which is supported by a natural gas purchase contract, the commission shall consider whether the price to be paid for such natural gas is the reasonable market price thereof at the point at which the gas is to be delivered into the transportation facilities of the natural-gas company in or within the vicinity of the field or fields where produced, considering, among other things, whether such market price has been competitively arrived at, the effect of the contract upon the assurance of supply, and the reasonableness of the provisions of the contract as they relate to existing or future prices."

Moab, Utah, to Jensen, Utah, were kicked off first. R. H. Fulton has the contract for this work and has been moving equipment in. It is planned that one spread will start at Jensen and work south while another starts at Moab and works north.

The "initial pipeline system," the certified facilities the company plans to construct at this time, will be powered by eight compressor stations and will deliver approximately 293 MMcf/day. The additional facilities, including six additional compressor stations, necessary to bring the capacity of the pipeline system up to 343 MMcf/day, are planned for completion during the first and second years of operation of the pipeline.

The entire project of piping natural gas to the Northwest is now in high gear and rapidly gaining speed. A company official estimated it is a "safe guess" that natural gas will be available as far north as the Yakima (Wash.) valley by July 1, 1956.

New line of centrifugal compressors produced

Cooper-Bessemer Corp. is producing a line of centrifugal compressors, ranging in size and capacity from 500 to 65,000 cfm, that has been designed to augment the company's recipricating compressors now in service.

The growing potential for highly practical turbo-compressor machinery has long been under consideration by development engineers at Cooper-Bessemer. In recent years particularly, new gas compressing applications have sprung up in various industries that could be better served by rotating machinery, providing efficient prime movers could be developed.

Centrifugal compressors have economic advantages where pressure ratios are low, and loads and pressures are constant. Where such conditions prevail, centrifugal compressors can be installed in less space and on less costly foundations.

Thus far, turbines and electric motors have been used principally for driving centrifugal compressors. The choice of compressor driver is based, in practically all cases, on existing facilities, plant heat balance, or an economic study of energy and installations costs.

Turbines of different types are today the most favored drivers for centrifugal compressors. Steam turbines prove economical where steam is required for other purposes. Free-piston gas turbines and even direct-red gas turbines are favored where natural gas or fuel oil is available at reasonable costs. Expander turbines are being given greater consideration where high pressure gases are required in the process and energy can be reclaimed by expanding the gases to lower pressures.

Outside of the petroleum and petrochemical industries, immediate markets include air conditioning, for which the centrifugal compressor is highly practical, according to Stanley E. Johnson, vice president and director of sales for Cooper-Bessemer. Considerable progress has already been made on that application. Prototypes of centrifugal compressors for refrigerators have already been designed.

Cooper-Bessemer's latest centrifugal compressor is the result of 10 years of research work. The first development was a turbo-charger for use on the company's 4-cycle gas engines, capable of developing up to 5000 hp.

Court clears way for American Louisiana line

By refusing to grant Panhandle Eastern Pipe Line Co. a hearing on its objections to the American Louisiana Pipe Co. project, the Supreme Court has cleared the way for American Louisiana to start construction of its 1300-mile line from Louisiana to Michigan.

Panhandle had appealed a recent ruling of the court of appeals for the District of Columbia, which held Panhandle would not be "aggrieved" if the new pipeline were built. From the beginning, Panhandle has fought the proposed line, contending that the new system would cut into its markets and that there was no substantial evidence of a big enough market to absorb American Louisiana's gas.

The court of appeals also held that American Louisiana's gas would not displace Panhandle's but would help meet growing demands for natural gas in Michigan and Wisconsin.

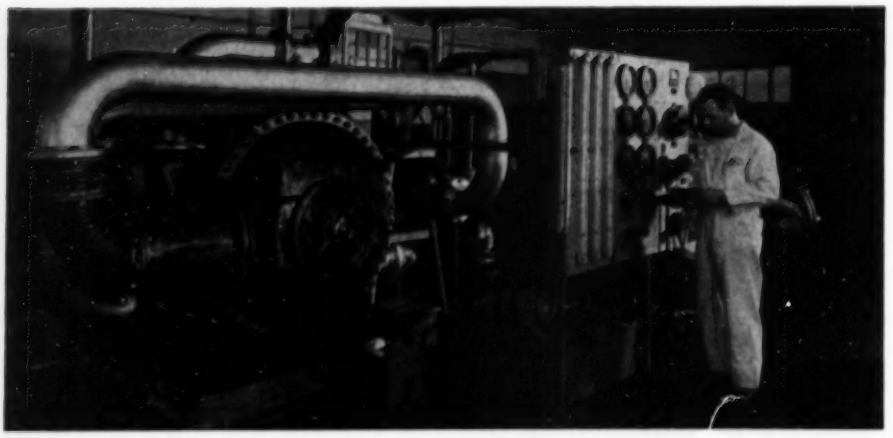
Northern's uniform rates "unduly discriminatory"

The FPC has ruled that the use of uniform rates by Northern Natural Gas Co., Omaha, for its entire natural gas system is "unduly discriminatory and preferential," and directed the company to divide its system into three zones with different rates for each (Docket G-2217), thus reversing the decision of Presiding Examiner Glen R. Law, issued last Nov. 18, who found that Northern's use of uniform rates should not be changed at the present time.

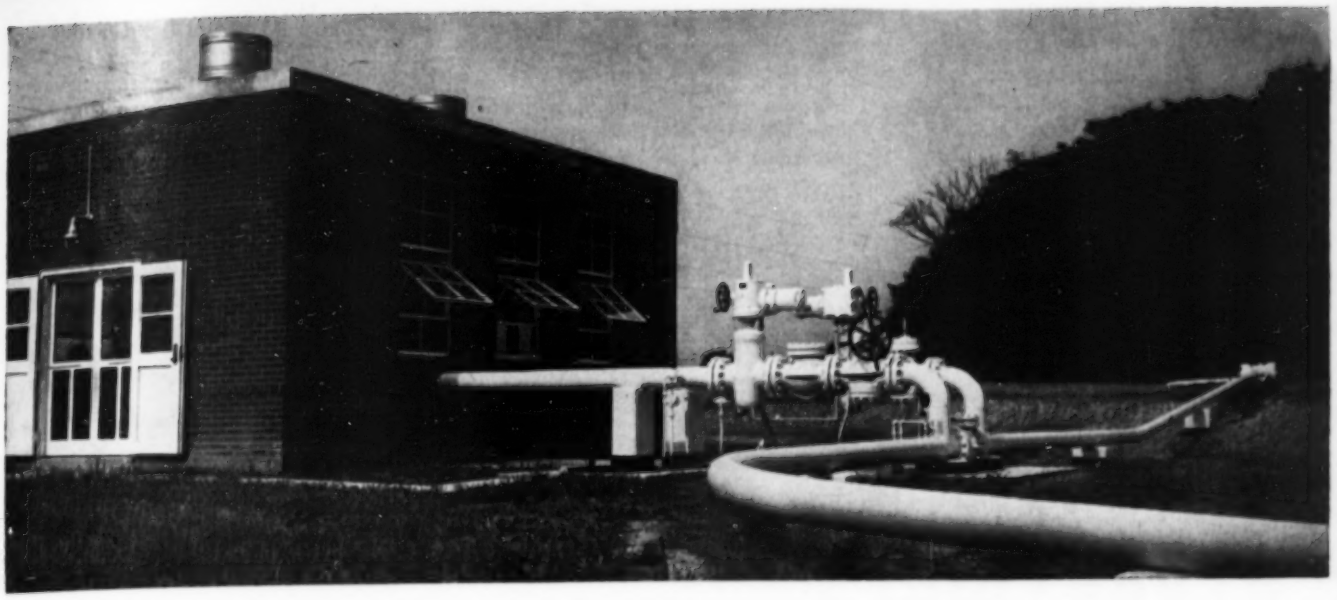
The commission directed Northern, within 15 days, to file revisions in its gas tariff to provide for the division of its system into the three rate zones, and to revise its tariff sheets to provide for a 2-cent per thousand cubic foot rate differential between each of the zones.

In concluding that the rate zones should be established, the FPC declared that "it is a simple economic fact that the delivery cost of natural gas increases in close proportion to the length of the transmission line of any given size. Therefore, unless other circumstances are present which outweigh the importance of the length of transmission required to effect delivery, the distance factor is the prime determinant of the cost of rendering service." The commission further stated that Northern's present use of uniform rates throughout its system "results in the shifting of transmission cost from those whose service requires its incurrence by reason of the greater transportation distances to others who are not responsible for such cost —and who are not benefited correspondingly."

The commission's plan divides Northern's service area north of its Bushton, Kans., compressor station into three nearly equal zones. More than 99% of Northern's jurisdictional sales are made north of Bushton. Zone 1 embraces all sales requiring transmission for a distance of 191 miles beyond Bushton, and also includes those sales made south of Bushton. All sales made on the west leg of Northern's system requiring transmission up to approximately 190



New centrifugal compressor developed by Cooper-Bessemer for use on gas transmission lines and other applications.



This Illinois pumping station is controlled by a man in Radio City

When dialed, the pumping station automatically sends its meter readings via teletypewriter to the dispatcher in New York.

Shell Oil Company's automatic pipeline pumping station in Dennison, Ill., is supervised and controlled over Bell System lines from an ordinary telephone dial in New York City—more than 800 miles distant!

For meter readings, Shell's dispatcher in New York's Radio City dials a number. Back on the teletypewriter from the Dennison station come suction and discharge pressures and motor current readings.

He dials other numbers to start or stop the pump, open or close valves or to summon an attendant.

This remote-control system keeps the pipeline—which carries 22 different finished petroleum products—operating smoothly from one central location. Dennison is only one of four similarly controlled pumping stations on the line.

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We supply the pipeline industry with reliable private line telephone and teletypewriter service, maintain mobile radio facilities and provide channels for telemetering and supervisory control.

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miles beyond the Zone 1 northern boundary, and all sales made on the east leg requiring transmission up to about 190 miles, fall within Zone 2. Sales falling into Zone 3 require transmission for a maximum of approximately 180 miles on the west leg and 183 miles on the east leg beyond Zone 2's northern boundary.

The commission adopted, with certain modifications, the theory of the cost allocation procedure advocated by its staff. The FPC said that it found this theory, which involves the distribution to the various zones of the costs as allocated to functions for the 1954 settlement to be appropriate.

Commissioners Claude L. Draper and Nelson Lee Smith filed a joint statement dissenting in part. They concurred in the conclusion that Northern's uniform system-wide rate structure results in some discrimination and also agreed that rate zones should be established. However, pointing out that—according to the allocation method adopted in this case—the differential in average costs between Zones 2 and 3 is 3.06 cents per thousand cubic feet, they said they could see no reason for the majority's reduction of this amount from 3 to 2 cents. Declaring that while they recognized that some "softening" of the impact may be appropriate when departures from historical rate patterns are to be made, the two commissioners said that it would be more equitable to establish an initial differential of 2½ cents. This would be subject to further consideration and adjustment in Northern's pending rate case if the evidence there warrants it, they indicated.

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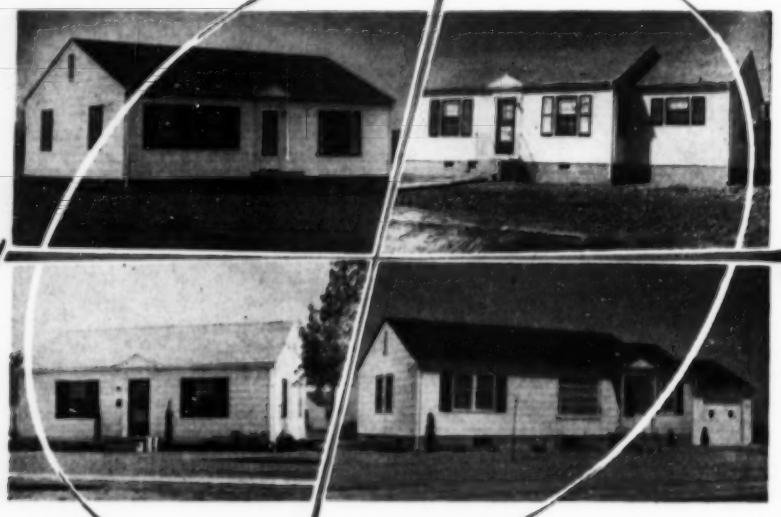

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STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS125 OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES

Gas engine-driven station being built by Transco

Transcontinental Gas Pipe Line Corp. will begin construction this month of a gas engine-driven compressor-station near Houston. A Nordberg "Supairthermal" gas engine will drive a single-stage DeLaval centrifugal compressor through a close-coupled speed-increasing gear. This is the first time an engine has been used as a prime power source for centrifugal compression on a natural gas transmission line.

The engine, rated at 3000 hp for this installation, is a four-cycle, V-type, spark-ignition, turbo-charged design that is expected to produce relatively low fuel requirements at a compression ratio of 1.133. The speed increaser will operate at a 10:1 ratio in transmitting the power to the conventional-type centrifugal compressor.

Initially, the single engine-compressor unit will be installed, but the station design is flexible so that additional units can be added if warranted. Transco plans to operate the station with four men (not on shift) immediately after it goes into service; however, it is anticipated that the complement will be reduced to two persons after operating experience has been gained. Completion is scheduled for Nov. 1 of this year.

Pacific Northwest asks FPC to okay Canada import

Pacific Northwest Pipeline Corp. has filed an application with the FPC to import gas from Canada through the facilities of Westcoast Transmission Co. Ltd (see *GAS*, January, page 134).

The Pacific Northwest filing included an application for a presidential permit to import and export gas from Canada, an application for an FPC order authorizing the import and export of gas from Canada as required under section 3 of the Natural Gas Act, and an application for a certificate of public convenience and necessity to build the facilities necessary to accomplish this.

Pacific Northwest received a certificate of public convenience and necessity from the FPC last June 18 giving it authority to serve the Pacific North-

west states with natural gas from the San Juan Basin. The new application is for the import of a supplemental supply of up to 300 MMcf daily of Canadian gas through a pipeline to be built by Westcoast, and to export minor quantities to British Columbia.

In its application, Pacific Northwest asks for authority to serve an additional 14 communities in Washington and Idaho, and to export gas to Vancouver and Trail, B. C. The major portion of the gas Pacific Northwest will take from Westcoast will be delivered to El Paso Natural Gas at Mountain Home, Idaho, for eventual use in the California market (see *GAS*, June, page 155).

Pacific Northwest proposes in its application to extend its line from Bellingham, Wash., north to a point on the Canadian border near Sumas, Wash., where it will connect with the proposed Westcoast pipeline.

The 14 additional communities in Washington and Idaho, Pacific Northproposes to serve are . . . through municipal systems in Washington—Buckley, Enumclaw, Ephrata, Marysville, Moses Lake, Quincy, Soap Lake, and Winlock . . . through the Cascade Natural Gas Corp.—Clarkston, Wash., and Lewiston, Idaho . . . and through the Kootenai Natural Gas Co.—Coeur d'Alene and Moscow in Idaho, and Colfax in Washington.

Examiner okays Transco plan despite opposition

A presiding examiner's decision, subject to review by the FPC, has authorized Transcontinental Gas Pipe Line Corp., Houston, to construct about 24.2 miles of line at a total estimated cost of $754,000 to enable it to receive and transport gas purchased from several independent producers. The decision also authorizes the producers to sell and deliver the gas to Transco.

Several of Transcontinental's customer companies, together with the public service commission of the state of New York, opposed the applications in what Presiding Examiner Woodall described as an attempt to cause the commission to outlaw the first-party favored nation and escalation clauses contained in the gas purchase contracts. They urged that the applications be denied unless these clauses are eliminated and unless the applicants file and prove that the initial rates are "just and reasonable."

Presiding Examiner Woodall, however, declared that the opposing contentions all relate to issues not present in this proceeding. He said that as argued by the opponents the record is bare of any evidence to demonstrate that the terms of the producers' contracts are either just or reasonable. Asserting that

Through the rugged Smoky Mountains—

Blue Flag wraps entire 93.64-mile extension without a break

To protect the entire Topside Bristol Extension against corrosion, Tom Brown, Chief Engineer East Tennessee Natural Gas Company, specified Blue Flag glass fiber reinforcing pipe wrap.

Blue Flag wrapped the extension's entire 93.64 miles without a break, according to Mr. Brown. He writes:

"*During construction*, the pipeline was protective-coated against corrosion. Application was a standard 3/32" minimum-thickness coating, using Blue Flag Reinforcing Pipe Wrap for reinforcing the enamel.

"The total main line was machine field-wrapped. For over-the-ditch operation, Blue Flag Reinforcing Wrap proved very satisfactory. The wrap was easy to handle, light in weight but strong, with no breakage, and porous enough to release the gases. The total cost per foot was impressively low."

Blue Flag Pipe Wrap greatly increases enamel strength; offers exceptional resistance to cracking, thereby helping to prevent corrosion; adds years to a pipeline's service life. It is made of special highly inert glass and produced by L·O·F Glass Fibers' exclusive "Electronic-Extrusion" process. The uniform porosity of the fine glass fiber mat improves enamel distribution and greatly reduces the number of "holidays."

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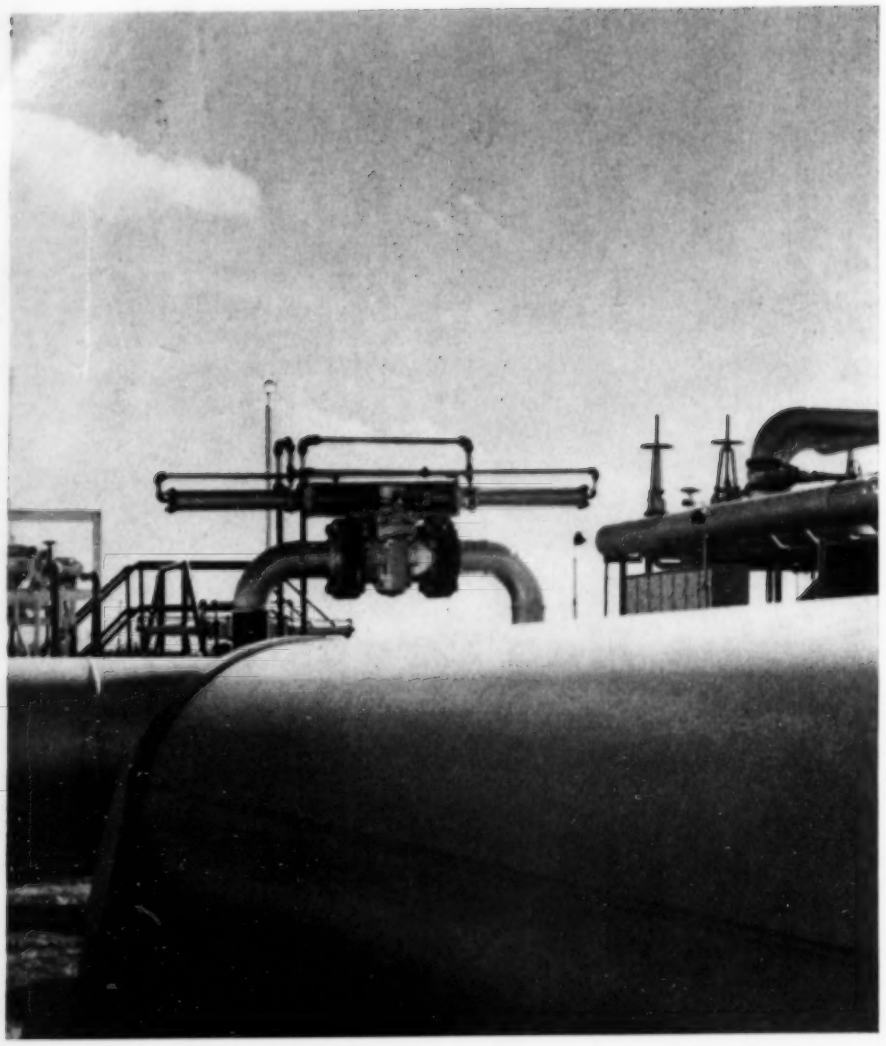

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When lightning strikes or power fails, this new valve keeps station on line. If power is not restored within adjustable time delay limit set by the valve (2 seconds to 2 minutes), station is blown down and lines vented. Write for data on this compressor station watchdog.

New AGA Code Revision Specifies Emergency Shutdown Facilities...

"Each transmission compressor station shall be provided with an emergency shutdown system by means of which all gas compressing equipment, all gas fires, and all electrical facilities in the vicinity of gas headers and in the compressor building can be shut down and the gas can be blocked out of the station and the station gas piping blown down." (per Paragraph 843.431, Emergency Shutdown Facilities, Revision of Section 8 of ASA B31.1).

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the converse of that statement is true, Presiding Examiner Woodall said that "no evidence exists to determine the justness or unjustness, reasonableness or unreasonableness of the rates for the natural gas being sold by the producers to Transcontinental." Hence, he continued, no finding or conclusion thereon can lawfully be made in this proceeding. He further declared that such evidence "could not lawfully be admitted because that would be converting this proceeding into a rate proceeding without the legally required notices under other sections of the [Natural Gas] Act and other law."

Colorado Interstate begins big construction job

Construction started June 10 on approximately 140 miles of 22-in. pipeline that is part of Colorado Interstate Gas Co.'s new line that will extend 380 miles from a connection with the Pacific Northwest pipeline, near Rock Springs, Wyo., eastward to Cheyenne and southward to the company's east Denver control station. The segment presently contracted for will cover the segment from the Denver station to a location approximately 3 miles south of Laramie, Wyo. Work on the remaining portion of the certificated line will be done during the construction season of 1956 and completion of the entire line is scheduled to provide for deliveries from the Pacific Northwest Pipeline Corp. in time for the 1956-57 winter heating season.

The Houston Contracting Co., Houston, has the contract for the Denver-Laramie section and expects to start laying pipe about July 1. In addition to the pipeline, three metering stations are included in the present construction. These meter stations are planned for Cheyenne, Greeley, Colo., and east Denver, respectively. It is expected that the current construction will be completed in about 4½ months.

The spread is slated to start at a location south of the Laramie river and move southward with the work. Over 21 thousand tons of steel will be required for the initial portion of the line. Nine thousand tons are being provided by A. O. Smith Corp., Milwaukee, an equal amount is to be furnished by Youngstown (Ohio) Sheet & Tube Co., and the remaining steel will be purchased from Consolidated Western at Provo, Utah. This construction will call for an expenditure of $8 million and involve about 150 men.

In addition to the cost of the initial part of the pipeline, Colorado Interstate has budgeted about $3 million for drilling exploratory and development gas

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4 new GALVOMAG anodes do the job of 5 conventional anodes . . . to reduce your original investment and installation cost, too

Let's take a new look at cathodic protection. Dow's new high potential anode, called GALVOMAG*, has 25% more current output than conventional anodes.

To put it another way—4 anodes now do the work of 5. It's easy to see why your installation costs in time and labor will go down in proportion.

In addition, economical protection in high resistivity soils can now be achieved. GALVOMAG's greater current output extends its use into ranges previously impractical for magnesium anodes.

Your Dow anode distributor is ready with all the facts and figures on GALVOMAG. Call him today. THE DOW CHEMICAL COMPANY, Midland, Michigan. *Trademark

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wells, and $4 million for extension of its gas gathering facilities in the Panhandle Field in Texas, the Keyes Field in Oklahoma, and the Hugoton and Greenswood Fields in Kansas.

Colorado Interstate and Pacific Northwest have signed a 20-year contract for the sale and purchase of natural gas. Under the contract, Pacific Northwest will sell 100 MMcf/day of natural gas to Colorado Interstate on delivery at the Rack Springs, Wyo., connection. Colorado Interstate will pay a monthly demand charge of $1.52/Mcf of contract demand and a commodity charge of 13 cents/Mcf. At 100% load factor, this will produce an average price of approximately 18 cents/Mcf. The contract provides price adjustments for variation in the Btu content of the natural gas.

TET's 15.6 MMcf of gas allocated by FPC

An FPC presiding examiner has filed a decision, subject to review by the commission, allocating a total of 15,598 Mcf of natural gas per day from the pipeline system of Texas Eastern Transmission Corp., Shreveport, to 19 new or existing customers (Docket G-2573, et al).

Examiner Glen R. Law reserved decision, however, on the allocation of the remaining 712 Mcf of Texas Eastern's total available unallocated volumes of 16,310 Mcf per day.

Texas Eastern originally only proposed to sell an additional 3335 Mcf of natural gas to seven of its existing customers. The FPC subsequently consolidated the company's application with applications filed in July 1954 by two Illinois cities, Anna and Jonesboro, which were seeking supplies of gas from Texas Eastern, and an application by Mississippi Valley Gas Co., proposing to build pipeline facilities to supply Ethel and McCool, Miss., with natural gas to be obtained from Texas Eastern. Other cities and companies, seeking allocations of gas from Texas Eastern, were permitted to intervene in the proceedings. Two of the seven customers named in the original application of Texas Eastern later withdrew their requests for additional gas.

Since Texas Eastern's total available unallocated volumes—16,310 Mcf per day—were less than the demands and requests for gas, a conference was held at the outset of the hearings, at which stipulated maximum day demands were agreed to by all parties to the case. The stipulation called for the total allocation of 15,598 Mcf per day to the 19 proposed or existing customers covered by the present decision.

Texas Eastern seeks to shift compressor station

Texas Eastern Transmission Corp. and Texas Eastern Penn-Jersey Transmission Corp. have jointly filed an application with the FPC for authorization to shift 10,000 hp on the Texas Eastern system to the Penn-Jersey system, and to construct additional horsepower on the Texas Eastern system and two small loop lines in the Philadelphia area.

The purpose of the proposed facilities is to give greater flexibility in Texas Eastern's Philadelphia-New Jersey delivery area, and to permit deliveries in that area of larger quantities of gas on peak days. The total capacity of Texas Eastern's system (combined with that of Penn-Jersey) is approximately 1,366,500 Mcf of gas per day, of which about 731 MMcf per day is available east of Oakford storage. The proposed facilities would increase that capacity east of Oakford storage to approximately 843 MMcf per day.

The proposed application includes a rearrangement of horsepower to shift an aggregate of 10,000 hp presently

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ROWAN AND HOPE installed a compressor station at its Sweetwater gasoline plant to convert to profit flare gas from nearby Nolan County Wells. Upon recommendation of the design engineer, the station was equipped with a 10SVG 550 h.p. Beaird-Ingersoll-Rand packaged compressor plant. Picking up 2,500,000 cubic feet of gas daily from the wells at 5 psig, the unit operates with three stages of compression. As the gas leaves each stage, it is cycled through the plant for processing. Finally with both gasoline and LP-Gas removed, the residue is delivered to the sales line at 525 psig.

Rowan and Hope have found the unit to be exceptionally economical. Definite savings in both time and cost of installation were realized by the shipment of the compressor plant, fully assembled, directly to the Sweetwater location. And in 15 months of continuous service it has been down only a few hours. In each instance, the trouble has been of a minor nature.

Designed for unattended operation, the unit is equipped with automatic controls that permit it to speed up or slow down while maintaining constant processing pressure and volume. Other special controls watch over the unit to shut it down should any unusual operating conditions develop.

Bring your compression problems to Beaird. Our gas engineers are available to help you find an economical solution.

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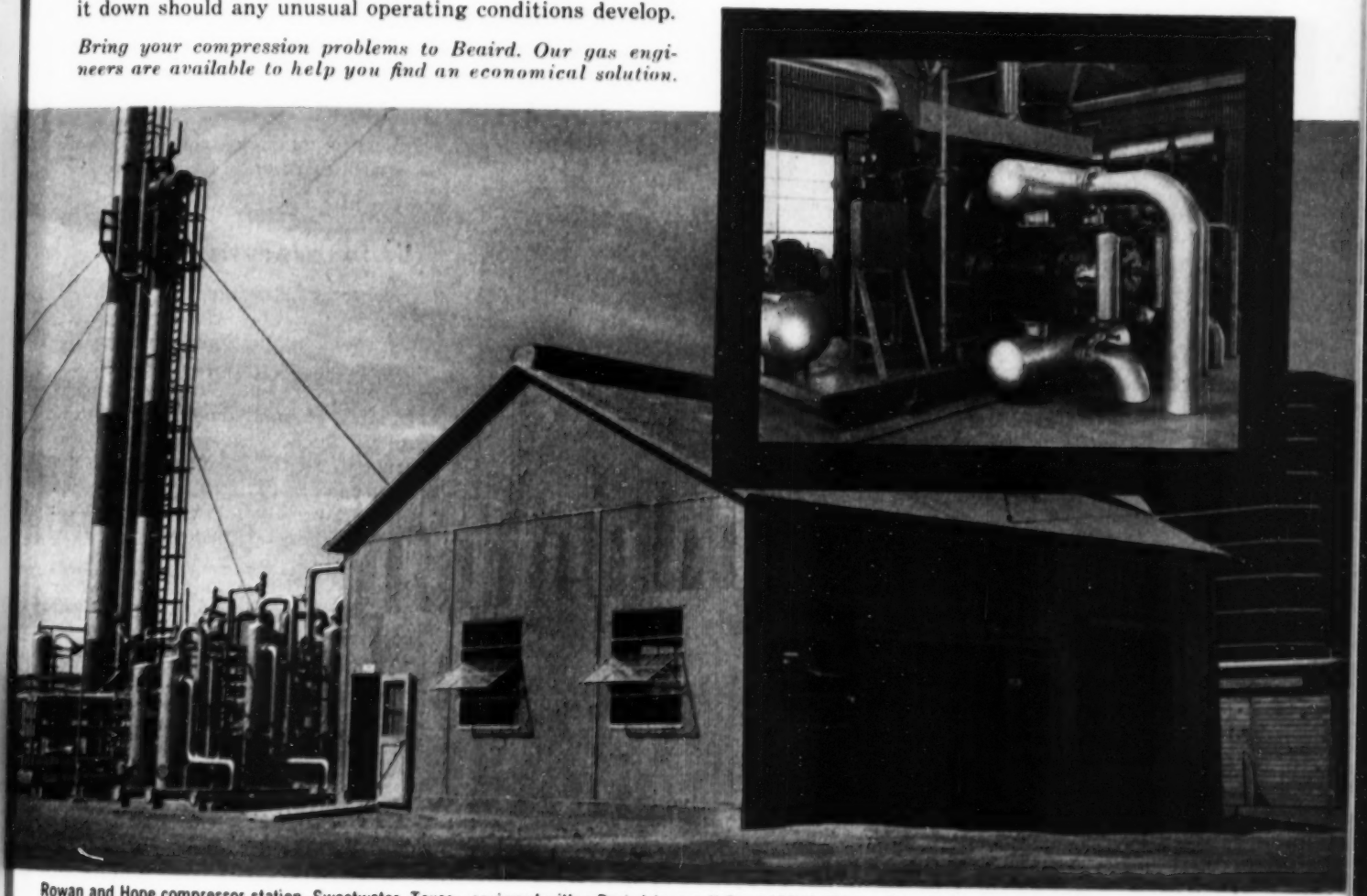

Rowan and Hope compressor station, Sweetwater, Texas—equipped with a Beaird-Ingersoll-Rand 10SVG 550 h.p. Four Cycle gas engine driven compressor, Young radiator and all necessary equipment and controls. Other sizes 110 to 660 h.p.

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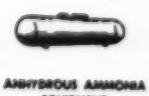

ANHYDROUS AMMONIA EQUIPMENT

LP-GAS SYSTEMS

pipeline news • *Cont'd.*

installed or authorized for construction at Texas Eastern's Phoenixville, Chambersburg, and Wind Ridge, Pa., stations to the Penn-Jersey system, the construction of 3300 additional reciprocating horsepower at Texas Eastern's Linden, N. J., station, and the construction of approximately 11 miles of pipeline loops in the Philadelphia area. New Penn-Jersey facilities would include a 5000-hp gas turbine centrifugal station at Perulack, Juniata county, Pa., and a 5500-hp gas turbine centrifugal station at Grantville, Dauphin county, Pa.

Westcoast completes contracts for gas supply

Westcoast Transmission Co. Ltd. has completed contracts for the supply of natural gas for its pipeline system.

Frank M. McMahon, president, announced that the company has signed with major producers for a 20-year supply of gas at the rate of 355 MMcf per day. This is the amount contracted for by American and Canadian distributors for their initial requirements.

Producers signing with Westcoast include Pacific Petroleums Ltd. and Peace River Natural Gas Co. Ltd., which companies will supply 250 MMcf per day. Other suppliers will be Imperial Oil Ltd., Royalite Oil Co. Ltd., Canadian Fina Oil Co. Ltd., Gulf States Oil Co. of Canada, J. B. White and A. M. Lloyd, Fargo Oils Ltd. and Associates and Pathfinder Petroleums Ltd., Shell Oil Co. and British American Oil Co.

Tennessee Gas buys oil and gas properties

An agreement has been reached for the sale to Tennessee Gas Transmission Co., Houston, of a portion of the assets of the Bay Petroleum Corp., Denver.

At a meeting of Bay Petroleum stockholders, more than 96% of the outstanding shares were voted in favor of a proposal to liquidate the company, and liquidation accordingly will go forward.

The properties to be acquired by Tennessee Gas include oil and gas producing properties located principally in Texas, Kansas, Oklahoma, Colorado and Wyoming, and two refineries, one at Denver and the other at New Orleans. Expenditure by Tennessee Gas will approximate $19 million.

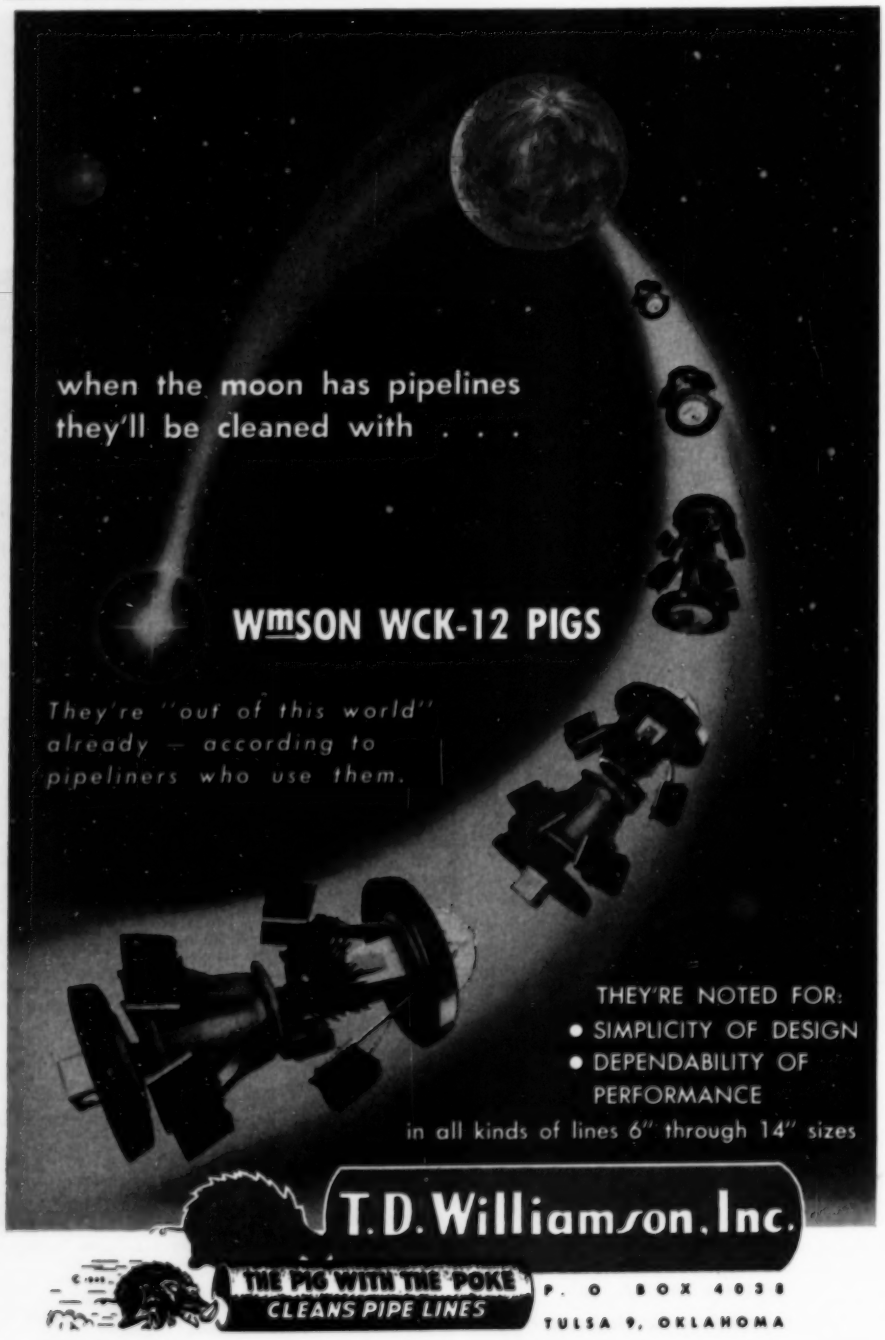
The proposed acquisition is in line with the previously announced policy of Tennessee Gas of expanding its oil and gas properties through purchase as well as by exploration and development.

Southern California firms file for expansion job

Southern California and Southern Counties Gas Co.'s, Los Angeles, have filed a joint application before the California Public Utilities Commission for a certificate of public convenience and necessity to build their proposed $31 million pipeline that will bring an additional 225 MMcf/day of natural gas into southern California from the San Juan basin through El Paso Natural's proposed new line that will parallel its big-inch, San Juan pipeline system. El Paso will deliver to the California companies at Topock, and the latter's proposed 30-in. pipeline will bring the gas on in to near Alhambra, Calif. Announcement of the over-all program of which this plant is a part was made last month. (GAS, June 1955, p. 155-56.)

In their application, SoCal and So-Counties reveal they plan to install a 10,500-hp compressor station at Topock to send the gas on its 277-mile trip through the 30-in. Topock-Alhambra line. Their plans call for three stages of construction:

1. Scheduled for construction in 1956 are 168 miles of 30-in. line, westerly from Bagdad to an existing station at Haskell (near Sepulveda dam in San Fernando valley), and a pressure limit-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YOUNGSTOWN LINE PIPE EASY TO WELD

● Talk to your welder about this advantage. He will tell you that Youngstown A.P.I. Electric Weld Line Pipe has good, clean, consistent beveled ends, uniform wall thickness and diameter. This means the ends line up well. Control of chemical composition is designed to permit maximum weldability. These factors result in faster installation and lower costs to you.

SPECIFY QUALITY V YOUNGSTOWN SERVICE

ELECTRIC WELD LINE PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

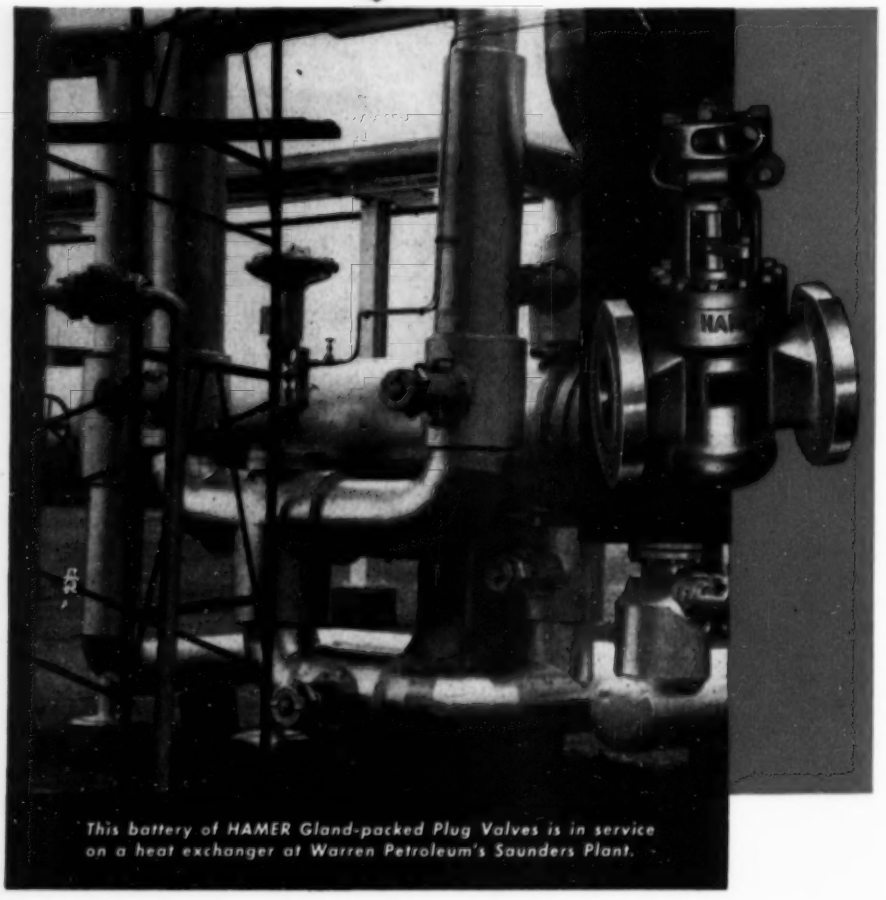
Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices: Youngstown 1, Ohio • Export Office: 500 Fifth Avenue, New York 36, N. Y.

You can repack

HAMER G. P. PLUG VALVES

under full operating conditions



This battery of HAMER Gland-packed Plug Valves is in service on a heat exchanger at Warren Petroleum's Saunders Plant.

HAMER Line Blind Valves

Built for strength and durability, Hamer Line Blind Valves are the modern means of blinding pipe lines quickly and effectively. A one-man, one-minute operation. Cuts costs, and speeds up operations.

Shutting down to change valve packings costs dearly in time and money. That's why Warren Petroleum uses Hamer gland-packed Plug Valves. Not only can Hamer gland-packed plug valves be repacked under full operating conditions, but because of the exclusive plug adjusting nut, a feature of all Hamer Plug Valves, the valves can't stick or freeze. No matter what the time lapse or service you have positive E-Z turn control at all times.

Send for FREE Catalog

HAMER VALVES, INC.

2919 Gardenia Ave., Long Beach 6, Calif.

Representatives throughout the World

ing station at Granada Hills (also in the valley) at an estimated cost of $15.7 million.

2. In 1957, about 25 miles of 30-in. will be built from the Haskell to the Alhambra compressor stations, and this phase includes the construction of metering facilities at Granada Hills and Glendale. They estimate $3.6 million will be spent for this construction.

3. The construction program will be completed in 1958 with the installation of an 85-mile Topock-Bagdad link of 30-in. line, mainline metering facilities near Topock, and the new compressor station. The expected cost of the 1958 phase will be $11.3 million.

Should the new line and facilities not be feasible, the application contains an alternate plan under which SoCal and SoCounties would receive an additional 100 MMcf/day from El Paso at Blythe.

GAS pipeline notes

Texas Gas Transmission Corp., Owensboro, Ky., has been authorized by the FPC to merge two south Louisiana gas distributing subsidiaries into the parent company. Affected are Louisiana Natural Gas Corp. and Texas Northern Gas Corp., both of Lake Charles.

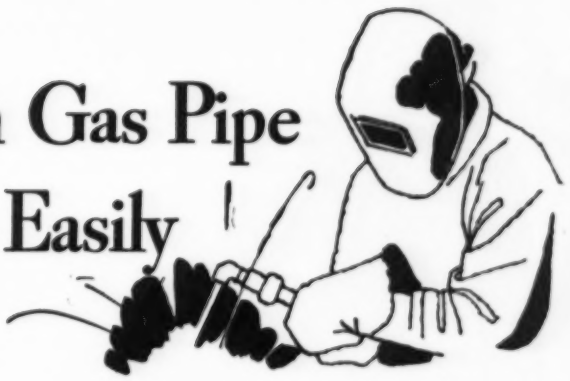
FPC has affirmed a presiding examiner's decision authorizing Montana-Dakota Power Co., Butte, to import from Canada up to 100 MMcf of gas per day, with an annual maximum of 20 billion cu ft (see GAS, May, page 162).

Central Kentucky Natural Gas Co., Charleston, W. Va., a Columbia Gas System subsidiary, has been authorized to acquire and operate the natural gas pipeline facilities of the Frankfort (Ky.) Natural Gas Co., one of its wholesale customers.

New York State Natural Gas Corp., Pittsburgh, Pa., plans to build approximately 21 miles of natural gas transmission line, paralleling a section of existing line, in Wyoming and Livingston counties, N. Y. (Docket G-8568), at an estimated cost of $1,225,000. The proposed new section of pipe would complete the looping of the company's existing Line No. 14, which extends from a point in Potter county, Pa., to a connection with Rochester Gas & Electric Corp. near Caledonia, N. Y.

The Youngstown (Ohio) Sheet & Tube Co. will build a new seamless tube mill at the company's Indiana Harbor works in the Chicago district. Pipe produced in the new mill will range from 4½ to 9⅝ in. outside diameter.

Bethlehem High-Strength Gas Pipe Resists Fatigue—Welds Easily



Bethlehem High-Strength Gas Pipe is recommended for pipe-line compressor stations and other locations where severe vibrations or extremely high pressures are encountered.

This pipe is fabricated from as-rolled plates of Mayari R, Bethlehem's high-strength low-alloy steel. Mayari R has a yield point of 50,000 psi min, an endurance limit of approximately 50,000 psi, high corrosion resistance and excellent workability and weldability.

RESISTANCE TO FATIGUE—Mayari R steel's endurance limit is unusually high—about 50,000 psi (60 to 75 pct of its tensile strength of 70,000 psi minimum). In addition, Mayari R steel is extremely ductile, with 22 pct minimum elongation in 2 in. Pipe fabricated from Mayari R plate has the exceptional endurance strength, extreme ductility and high impact qualities needed for handling vibration, pulsation and variable shock-loadings.

LIGHTER WALLS—When you use Bethlehem High-Strength Gas Pipe you can specify much lighter walls than with ordinary carbon-steel pipe. This results in savings in material, as well as in the cost of transportation, handling and field welding.

WELDS READILY—Bethlehem High-Strength Gas Pipe is readily welded by following normal field-welding procedures, using mild steel electrodes.

FOR NORMAL PIPELINE SERVICE we recommend Bethlehem Gas Pipe fabricated from carbon steel, meeting specifications ASTM A134 or API 5LX42. Comparative weights and test pressures for these grades of pipe, as well as for pipe made from Mayari R, are shown in the table below.

All grades of Bethlehem Gas Pipe are made in 40-ft lengths, with beveled or square ends, and in all diameters from 18 in. OD. We can grit-blast, prime, coal-tar enamel and wrap the pipe to your specifications.

A phone call or letter to the nearest Bethlehem sales office will bring you full information about Bethlehem Gas Pipe, in Mayari R or carbon-steel grades.

Comparative Maximum Test Pressure: MAYARI R, API 5LX42 and ASTM A134 Steel Pipe

Pipe OD In.	¼ IN. THICK				⅜ IN. THICK				½ IN. THICK				¾ IN. THICK				1 IN. THICK			
	Wt lb per ft	Test Pressure psi Mayari R	API 5Lx42	ASTM A134*	Wt lb per ft	Test Pressure psi Mayari R	API 5Lx42	ASTM A134*	Wt lb per ft	Test Pressure psi Mayari R	API 5Lx42	ASTM A134*	Wt lb per ft	Test Pressure psi Mayari R	API 5Lx42	ASTM A134*	Wt lb per ft	Test Pressure psi Mayari R	API 5Lx42	ASTM A134*
18	49	1180	990	665	73	1770	1490	960	96	2360	1985	1275								
20	54	1120	920	575	81	1590	1340	860	107	2130	1785	1150								
22	63	965	820	520	93	1450	1220	815	118	1935	1630	1040								
24	67	885	750	475	99	1330	1120	745	130	1770	1490	955								
26	73	820	690	440	107	1225	1030	690	141	1635	1380	880	202	2450	2050	1325				
28	79	760	640	405	117	1140	955	640	153	1515	1275	820	219	2270	1910	1225				
30	85	710	595	380	125	1060	895	600	164	1415	1190	765	235	2130	1785	1145				
32	92	665	560	355	134	1000	835	560	176	1325	1115	715	252	1990	1675	1075	330	2650	2230	1430
34	97	625	525	335	143	940	785	505	187	1250	1050	675	268	1875	1575	1010	352	2500	2100	1350
36	105	590	495	315	152	885	750	480	200	1180	980	635	285	1770	1490	950	374	2360	1980	1275
42	118	505	425	270	173	760	640	410	228	1010	850	545	334	1525	1275	815	440	2020	1700	1090
48	135	440	375	235	199	665	560	360	263	885	745	475	384	1325	1115	715	506	1770	1485	955
60	170	355	300	190	252	530	450	285	331	710	595	380	483	1060	890	570	638	1415	1190	765
72	210	295	250	160	306	440	375	240	403	590	497	320	582	885	740	475	770	1180	990	635
84	238	250	215	135	353	380	320	205	464	505	425	270	672	755	635	410	902	1010	850	545

*ASTM A283 Grade B, to be used when ordering to ASTM A134 Specification. If ASTM A283 Grade C is used instead, the test pressures may be increased by 11 pct. Pipe can be furnished in diameters intermediate to those shown above.

Test pressures above are based on stressing steel to 85 pct of minimum yield point:
Mayari R—85 pct of yield point = 42500 psi
API 5LX42—85 pct of yield point = 35700 psi
ASTM A134—85 pct of yield point = 22950 psi
Formula used: $P = \frac{2ts}{D}$

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

EITHER WAY...

ROSKOTE PAYS

Whether applied by Roskoter* (top), brush (bottom) or spray, Roskote *cold-applied* mastic's drying speed and handling ease cut manhours from work schedules. Yet it costs only three cents per square foot of coverage.

Roskote dries to the touch in 20 minutes and is ready for backfill in an hour. It bonds readily to previous coatings of coal tar or asphalt and is *non-toxic.*

This tough, natural resin-base mastic sets to a flexible film without brittleness or sag through a temperature range of —40°F to 375°F . . . withstands the pressure, strain and abrasion of the meanest soils. Roskote alone has an electrical resistivity of 20 megohms per sq. ft. and is highly resistant to the corrosive attack of acids, alkalies, salts and moisture.

Find out for yourself why over 100 major utilities and pipeline companies specify Roskote for their "tough" jobs. Write for complete technical information and free sample, and while you're at it ask about application by Roskoter, Royston's revolutionary new coating device.

*Patent Applied For

ROYSTON
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BOX 112-B, BLAWNOX
PITTSBURGH 38, PA.

District Offices
P. O. Box 1084
N. Decatur Station
Atlanta, Georgia

•

P. O. Box 1753
Tulsa, Oklahoma

ROSKOTE

GAS new pipeline products

(For additional information, use coupon on page 74.)

19 Actuating Instrument

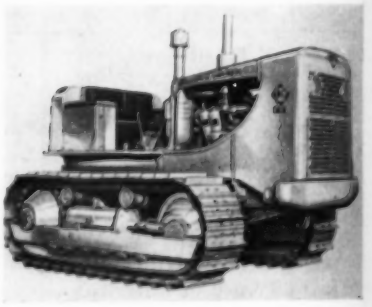
An automatic, all-electrical device for initiating action when a predetermined value is reached has been announced by General Electric's instrument department.

To be installed on switchboard or panel instruments, the system electrically picks up the signal from the instrument pointer. Because control of important variables is automatic, human errors and expenses can be reduced.

The control initiating instrument is suitable for one-set point or two-set point initiation. The load relay supplied is rated at 120/240 volts, 10/5 amps, single pole double throw.

General Electric Co.

■



20 Crawler Tractor

Allis-Chalmers announces its second completely new crawler tractor this year, the 31,500-lb HD-16, available with torque converter drive and standard transmission.

The HD-16 has the new Allis-Chalmers 6-cylinder, 844-cu in. diesel engine, which develops 150 net engine hp at 1800 rpm with torque converter and 140 net engine hp at 1600 rpm with standard transmission.

Maximum drawbar pull of 60,000 lb is obtained with torque converter drive.

New features of the HD-16 include "wrap-around" radiator guard, which

New as Tomorrow!

for the important

450-470 mc band...

RCA Carfone FOUR/FIFTY 2-Way Radio

It's all new! It's designed by RCA especially for the important 450-470 mc band! And like other new Carfone equipment it features shadow-box styling in the desk station... compact sectionalized drawer-type mobile equipment... and a triple bonus in its engineering, including:

1. SUPERIOR PERFORMANCE

...thanks to high-efficiency loudspeaker.
...with best frequency stability without ovens.
...operates on 50 kc channels.

2. PROTECTED INVESTMENT

...because of complete 6-12 volt convertibility.
..."Sealed Selectivity" tuned IF filter—anticipates future channel changes.
...operating on any frequency in the 450-470 mc band.

3. LOWER OPERATING COST

...stemming from lowest tube replacement cost, fewest tube types (requiring low tube inventory).
...Rainbow Tuning—color directed, cutting maintenance hours.

"Get the Best!"

RCA DISPATCHER 2-WAY RADIO TO DRIVER

Mail Coupon Below For More Details

RCA®

RADIO CORPORATION of AMERICA

COMMUNICATIONS EQUIPMENT CAMDEN, N.J.

Radio Corporation of America
Communications Equipment
Dept. T-180, Building 15-1, Camden, N. J.

Please send me information on the new RCA Carfone "450" 2-Way Radio.

Name_____

Title_____

Company_____

Address_____

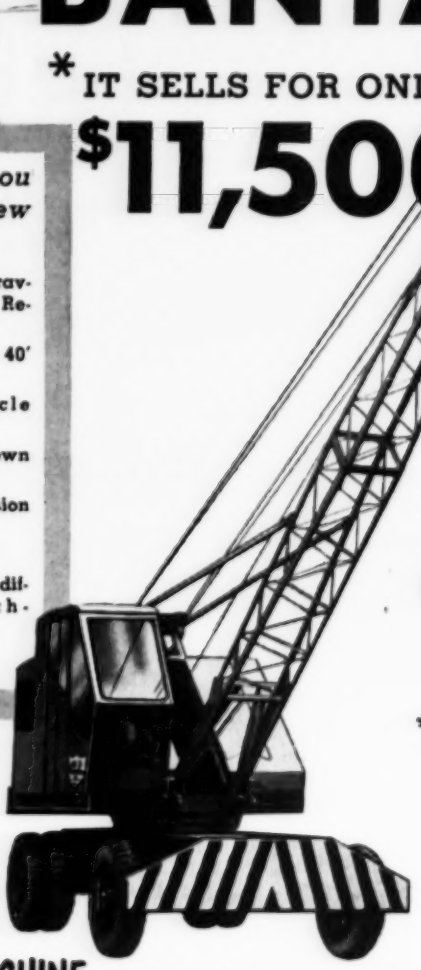
City_____ Zone_____ State_____

NEW 6 TON SELF-PROPELLED BANTAM!

* IT SELLS FOR ONLY $11,500

Look what you get in the new CR-35!

- Independent Travel, Forward & Reverse
- Turns INSIDE 40' Circle
- 360° Full Circle Swing
- Power Up & Down Boom Hoist
- Hydraulic Precision Steering
- All-Vision Cab
- Works with 9 different Attachments!



MODEL CR-35

* AS SHOWN with crane boom, outriggers, hook block, (less boom safety stops), f.o.b. Waverly, Iowa.

NO OTHER MACHINE of this size has ever offered so many time and money saving features! Lifting big loads . . . maneuvering in tight spots where other rigs can't go, the New BANTAM will let you realize greater speed and economy than you thought possible. You can't afford NOT to investigate the revolutionary New CR-35! WRITE TODAY.

CARRIER OR CRAWLER BANTAMS are outstanding performers, too! Mobile Carrier Bantam ideal for scattered assignments . . . travels up to 40 MPH! Crawler Bantam works in bad ground conditions where other rigs can't go . . . features 2-speed independent travel!

T-35A

C-35A

SCHIELD Bantam Co.

World's Largest Producers of Truck-Cranes and Excavators,

SCHIELD BANTAM COMPANY
268 Park Street, Waverly, Iowa

Please send me the FREE Brochure on Materials Handling with a Bantam!

G-10

Name _____

Title _____

Company _____

Address _____

new pipeline products • *Cont'd.*

tilts forward and down for easy accessibility; Allis-Chalmers diesel engine and matched torque converter power team; extra long-life ceramic master clutch lining; newly engineered power train with correct gearing for developing the high drawbar pulls plus big reserve capacity to provide maximum productive hours on the job.

Allis-Chalmers Manufacturing Co.

■

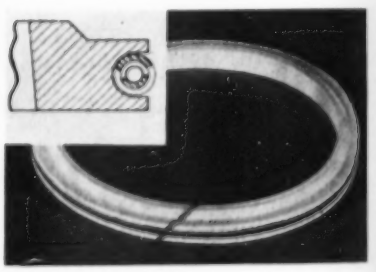
21 Fire Extinguisher

No inverting or bumping is necessary for operation of the Redi-Jet, a new type 2½-gal. water or anti-freeze fire extinguisher designed by Stop-Fire Inc.

The Redi-Jet is a one-hand operated stored pressure unit (not cartridge operated): all the action is at the top. The unit, filled with 2½ gal. of water or anti-freeze solution, is pressurized with air or nitrogen to 100 psi. Discharge is accomplished with a one-hand squeeze-grip operating lever located at the top of the extinguisher. This lever also serves as a carrying handle. Squeeze-grip action releases the pressurized water or anti-freeze charge in a stream that carries 35 ft or more. With anti-freeze solution, the Redi-Jet is effective from —40° to 120° F.

Stop-Fire Inc.

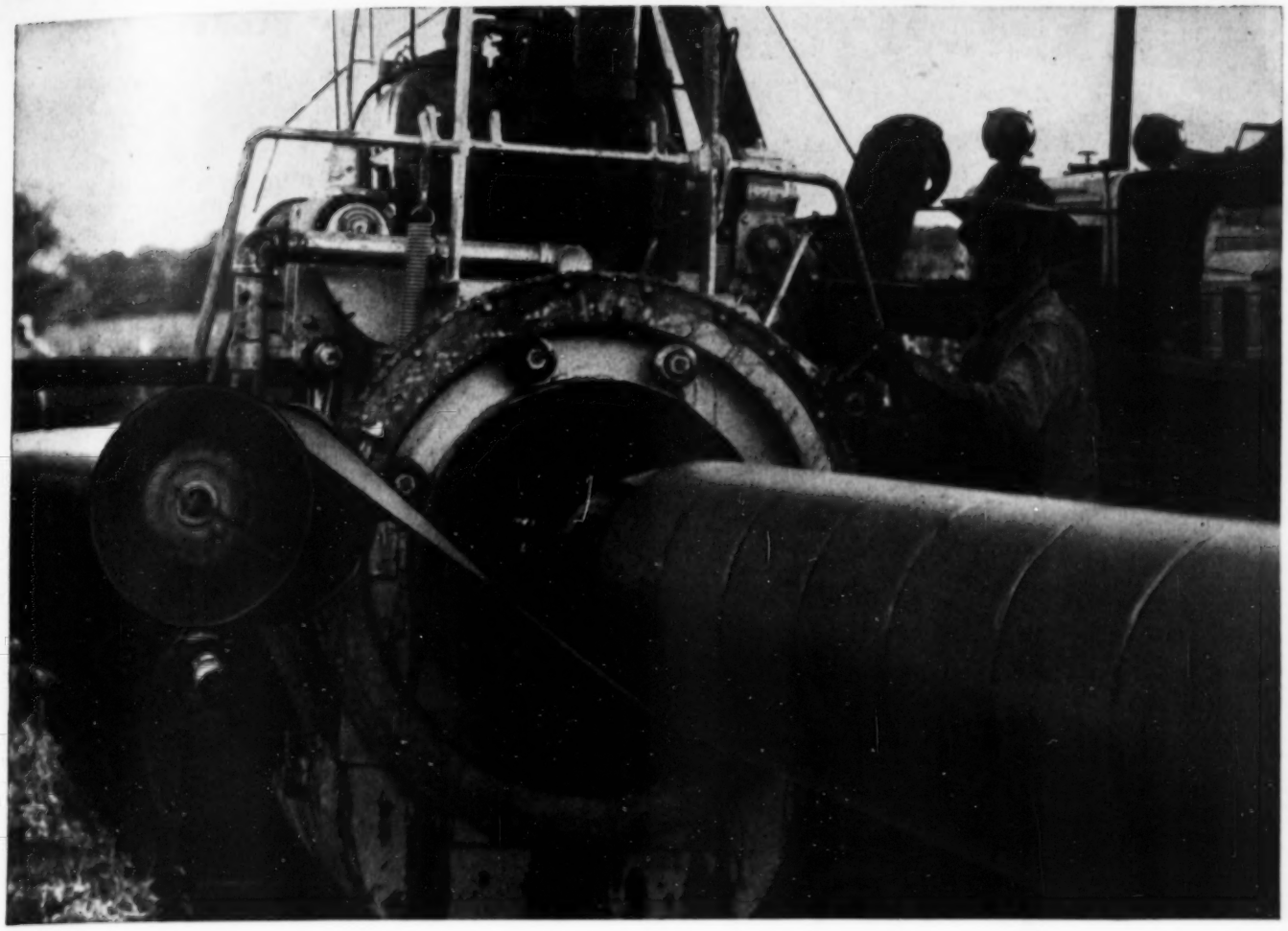
■



22 Scraper Ring

A new scraper ring, precision-made to aircraft tolerances from low-friction, non-scoring, tough, and extremely inert Kelton-T or Kelon-Y is available from W. S. Shamban & Co.

The Shamban S-11065 hydraulic piston rod scraper ring for aircraft and industrial use insures seal reliability and extends packing life by keeping dirt and other foreign matter away from vital O-ring seals. Shamban scraper rings are responsive to rod misalign-



"WE PREFER NO-OX-ID"

There are many reasons why NO-OX-ID has widespread preference among pipeline contractors, coating crews, independent applicators and utilities.

- NO-OX-ID saves on material, because less material coats more pipe per mile per day. Fewer "dope" kettles, trucks and "cats" are needed.
- NO-OX-ID is applied by hand, by Traveliner or at the mill.
- No irritating or noxious fumes with NO-OX-ID.

DEARBORN CHEMICAL COMPANY

Merchandise Mart Plaza • Chicago 54, Illinois

MAIL THE COUPON for booklet "Protecting Underground Pipe from Corrosion." It contains detailed information on NO-OX-ID and NO-OX-ID Casing Filler.

It pays to specify

Dearborn NO-OX-ID®

For long-term pipeline protection

Dearborn NO-OX-ID CM Casing Filler

NO-OX-ID CM Casing Filler protects against corrosion wherever pipelines are cased beneath highways and railroad crossings. CM Casing Filler (1) contains additives, inhibitors, wetting agents; (2) displays water up to 5% of its own weight; (3) is applied at 150° F; (4) is an electrical insulator; (5) is economical to apply.

Dearborn Chemical Company
Merchandise Mart Plaza, Dept. G, Chicago 54, Ill.

☐ Please send me booklet "Protecting Underground Pipe from Corrosion." ☐ Bulletin 3079 on NO-OX-ID CM Casing Filler.

Name.....

Title.....

Company.....

Address.....

City.....*Zone*.....*State*.....

Going down fast . . .
going down to stay!

. . . it's protected by Bitumastic® 70-B Enamel

When you want to put them in fast and be sure they'll last, you won't go wrong doing a pipeline job like this. The illustration shows work in the last 10-mile link in a network that now brings natural gas all the way from the Gulf Coast of Louisiana to Washington County, Pennsylvania — a distance of over 1,000 miles.

Because of the urgent need for gas, installation speed was of utmost importance. Permanence and strength, of course, were paramount considerations. To insure these factors, steel pipe and Bitumastic 70-B Enamel were selected. Machine cleaned, the pipe was given a coat of Bitumastic 70-B Primer. Then, Bitumastic 70-B was applied, to a thickness of 3/32 in. Finally, coal-tar saturated asbestos pipeline felt wrapper was applied to furnish a protective barrier against damage during handling and back-filling. All of these operations were performed over-the-ditch with a 38 to 44 foot section being run in, on the average, every two minutes.

It will pay you to specify Bitumastic Enamel for your next gas or oil pipeline. Many lines, protected by this durable enamel 20 or more years ago, are still in excellent condition today. Get in touch with us for complete details and estimates.

KOPPERS®

MADE ONLY BY KOPPERS
BITUMASTIC ENAMELS

KOPPERS COMPANY, INC.
Tar Products Division, Dept. 765-T, Pittsburgh 19, Pennsylvania
DISTRICT OFFICES: BOSTON, CHICAGO, LOS ANGELES, NEW YORK, PITTSBURGH, AND WOODWARD, ALA

ments, have less friction, and do not score the rod. They are for use in aircraft and hydraulic retracting cylinders, shock struts, hydraulic actuators of all types, control valves and pneumatic equipment. Operating temperatures range from —100° to plus 300° F.

The scraper ring, spring loaded to maintain firm contact on the rod, absorbs wear to provide longer life. Available in 72 sizes for rods ranging from ½-in. OD to 13-in. OD.

W. S. Shamban & Co.

■

23 Oil Filter

A cylindrical porous bronze oil filter, originally developed for use on cars, is now being introduced to industry for use on cars, trucks, tractors, marine, and industrial engines.

The filter removes particles as small as 39 millionths of an inch and, according to the manufacturer, it never needs replacing; an occasional cleaning restores it like new.

Engine Products Manufacturing Co.

■

24 Gas Cleaner

Blaw-Knox Co. is now manufacturing a new low-height type of gas cleaner. The cleaners are designed for district gas regulating and distribution points where height is a limiting factor.

Sizes of the new Blaw-Knox low-height gas cleaner range from 8 in. to 30 in. nominal diameter. The maximum gas capacities at 30 psig operating pressure run from 7000 up to 205,000 cu ft per hour, with more capacity at higher operating pressures. The new cleaners can be constructed for any pressure required.

In built-up areas cleaners frequently have to be installed in buildings or in underground vaults where the height is restricted. The new low-height Blaw-Knox gas cleaners have been designed for such indoor or underground installations.

The mist-extracting system is of en-

Service Vehicle. The 4-wheel drive 'Jeep' Truck provides transportation almost *anywhere*, for service installation, repair and regulator crews and equipment. It travels at highway speeds in conventional 2-wheel drive, but when the emergency requires, it shifts easily into 4-wheel drive, for extra traction on or off the road, where other vehicles can't go.

How 'Jeep' vehicles cut costs on installation and service jobs

Trenching. This 'Jeep'-propelled trencher digs clean-cut trenches up to 800 feet per hour and to 6 foot depth for service lines. Mobility of 'Jeep'-trencher unit saves travel time between jobs.

Meter Installation. The 4-wheel drive Universal 'Jeep' carries loads over fresh fill, right to the job. Its famed "go-anywhere" ability makes it ideal for transporting men, tools, equipment in new construction areas.

In almost every phase of gas distribution, 4-wheel drive 'Jeep' vehicles pay their way by doing more jobs—better!

With the extra traction of their 4-wheel drive, they carry men, equipment and supplies, or haul trailers wherever they're needed, over steep, soft, slippery or rocky terrain.

'Jeep' vehicles, with power take-off, operate welders... compressors... generators, and a variety of other equipment.

These multi-purpose vehicles save you time. Their long life and low maintenance costs save you money. See your Willys dealer for a demonstration, or write for information.

The 'Jeep'®

family of 4-wheel drive vehicles

WILLYS... makers of the world's most useful vehicles

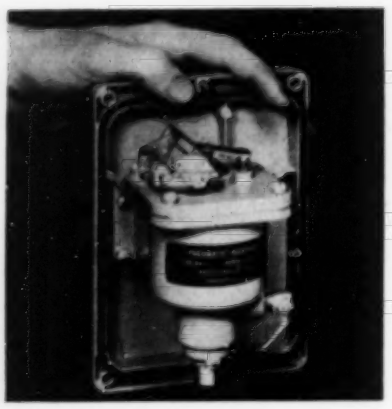
WILLYS MOTORS, INC., TOLEDO 1, OHIO

new products • *Cont'd.*

tirely new design. The entire cleaner is built for flexible operation as required at district regulators, where highly variable gas flows occur.

Blaw-Knox Co.

■



25 Pneumatic Receiver

Unlimited record grouping, shelf-to-operation simplicity, and drift-free stability are claimed for the new Bailey pneumatic receiver for instrument and control systems in power and process plants. Transmitted pneumatic signals of a measured variable are received by this unit, which drives a recording pen.

Arbitrary mounting of one to four identical units in any Bailey receiver recorder is made possible by plug-in, pin-positioned construction and a unique, indexed drive arm. Signals may be graphically recorded in any combination from any make pneumatic transmitter with 3-15 psig or 3-27 psig ranges.

Receiver is factory calibrated to less than ± ½% of range span and sensitive to signal changes of .01 psi. Ambient temperature changes between 30° F and 130° F are automatically compensated by an isoelastic spring. Hysteresis error is negligible.

Bailey Meter Co.

■

GAS trade literature

26 Compressor Bulletin

Gas engine-driven compressors in the 330- to 660-hp range are the subject of a 44-page bulletin released by Ingersoll-Rand Co. All important details of the machines are pointed out in cross-section drawings and a special cross-section in five colors traces the paths of fuel, exhaust gases, lubricating oil, cooling water, and the gas being compressed.

Ingersoll-Rand Co.

■

27 Control Bulletins

Minneapolis - Honeywell Regulator Co. has issued two new bulletins. (When ordering copies, use letter preceding description.)

a. A new handbook-type bulletin (1120) describes pneumatic controllers, their applications, and how to use them.

b. Catalog 5002 is a new issue of the composite catalog that briefly and concisely describes Honeywell industrial instruments and equipment, including the latest developments.

Minneapolis-Honeywell Regulator Co.

■

28 Strainer Bulletin

Schutte & Koerting has published two new bulletins. (When ordering copies, use letter preceding paragraph.)

A. Bulletin 9-S, presenting information on 15 types of strainers for high and low pressure service, contains 16 pages of dimensions and sizing charts, sectional drawings, and descriptive information on strainers.

B. Bulletin J-1 has been published to help engineers select the right type of jet apparatus for specific requirements.

Schutte & Koerting Co.

■

29 Pump Bulletin

"Vertical versatility" is the key product descriptive phrase in a new 16-page bulletin from Peerless Pump Division that describes and illustrates the application of Peerless vertical industrial service pumps for liquid transfer from short settings in both industrial and process services. Bulletin B-505 includes two pages of design recommendations and is illustrated with engineering diagrams in addition to installation photographs.

Peerless Pump Division

■

30 Pump Catalog

Catalog GK-954 from Bell & Gossett features a complete line of equipment for forced hot water heating systems and chilled water cooling systems. The 24-page catalog features nine pages of information on a complete line of circulating pumps for dozens of applications.

Bell & Gossett Co.

■

31 Hydraulic Drive Brochure

Hydraulic drives for aerial cooler fans is the subject of a new eight-page brochure published by the Berry division of Oliver Iron & Steel Corp. The bulletin (FD-1) contains circuit diagrams, mounting dimensions and drawings, cutaway view illustrating design and construction details.

Berry Division

Correction

In the worksheets (Page 127) that accompanied the article "Design of Gas Meter Station Flow Measuring Facilities," in the May issue of GAS (pp. 125-128) several errors occurred. Corrections should be made as follows:

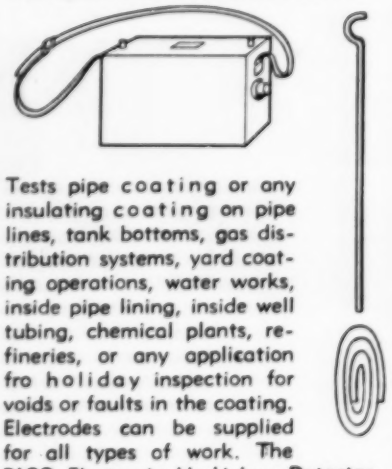
Worksheet No. 1 of 4: F_{pb} value shown as "0.3886" should be "0.9886."

Worksheet No. 2 of 4: Starred note at bottom of table shown as "*From Table 1" should read "*From Table 3."

Worksheet No. 3 of 4: Boxes titled "Duplex Type B (10" and 100")" and "Positive Displacement" should be checked to indicate meter selected for the first run.

Worksheet No. 4 of 4: In "Design Comments" at the bottom the phrase "Beta Rates 0.477" should read "Beta Ratio 0.477."

PICO ELECTRONIC HOLIDAY DETECTORS



Tests pipe coating or any insulating coating on pipe lines, tank bottoms, gas distribution systems, yard coating operations, water works, inside pipe lining, inside well tubing, chemical plants, refineries, or any application fro holiday inspection for voids or faults in the coating. Electrodes can be supplied for all types of work. The PICO Electronic Holiday Detector uses a 6 volt dry battery with an output of 18,000 volts D.C. It is mounted in a Plexiglas housing and weighs 13 lbs. Comes complete with pusher-handle and 7 Foot Electrode Spring. Price $290.00. Line-traveling type slightly higher. Write for literature.

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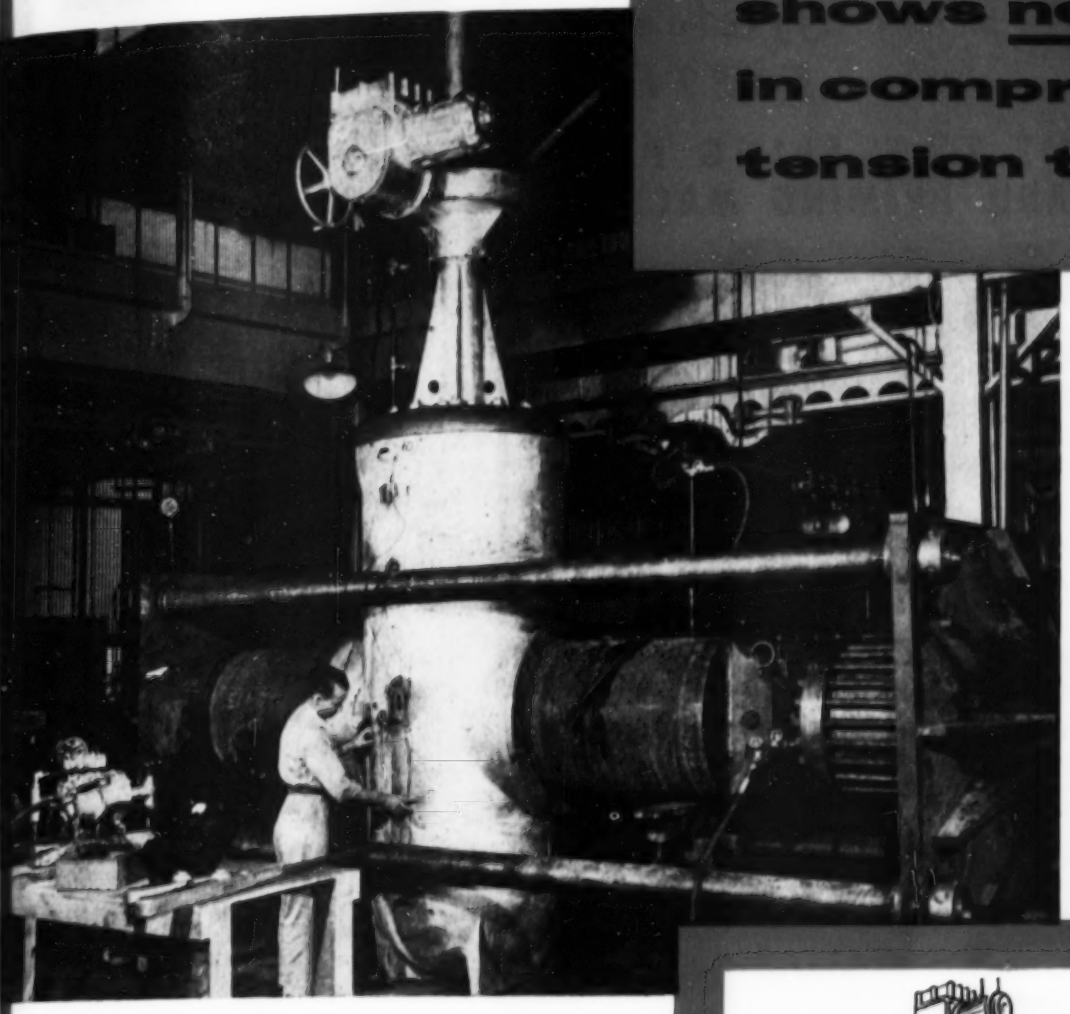
W-K-M Valve shows no leak in compression-tension tests



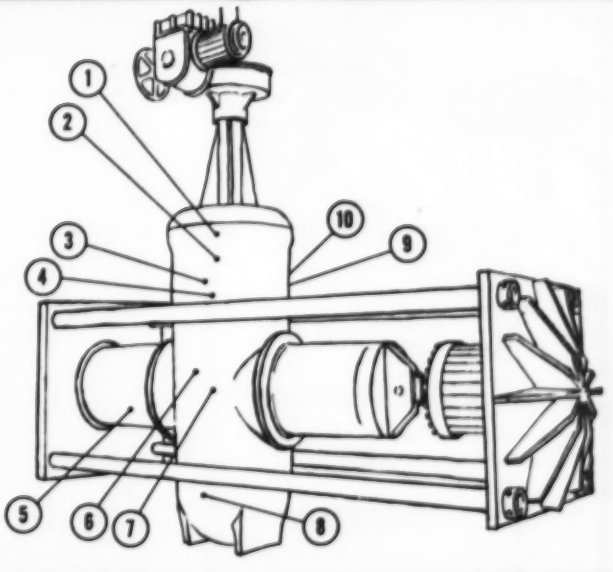
A special test was made in the W-K-M plant to determine what effect external compression and tension loads would have on seal-off and operation of a W-K-M Valve.

This test was conducted using a 30" ASA 400 p.s.i. weld-end gate valve operated by an electric motor. Ten strain gages were placed in the valve at locations shown on the diagram at right.

Using a hydraulic cylinder, an external differential tension load of 675 tons was applied to the valve while maintaining maximum working pressure against the gate.

During the tests the recorded strain-gage readings indicated no fibre stresses in excess of code allowables, indicating no appreciable body distortion. The valve did not leak and operated freely under all conditions.

W-K-M Pipeline Valves have been tested and proved in the laboratory and out on the line for more than thirty years. They offer the world's finest valve performance. Ask a W-K-M sales engineer to demonstrate a scale model valve.



The above sketch shows the placement of the strain gages used in the test.

W-K-M Valves

W-K-M Manufacturing Company, Inc.
A subsidiary of ACF Industries Incorporated
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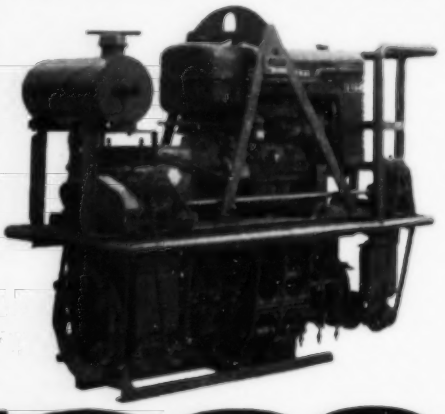
This versatile pipe cleaning and priming machine can be used for line traveling operation or with stationary base (shown at right) for yard cleaning and priming—either way it is better built and more efficient to give you faster, trouble-free service. Crose cleaning and priming machines are available for all sizes of pipe including 36"



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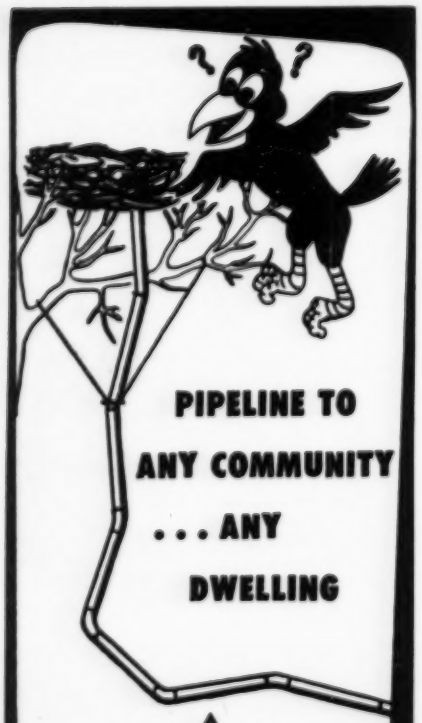

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FRANK M. PARTRIDGE, formerly gas measurement engineer with Southern California Gas Co., has joined Fish Northwest Constructors Inc. as gas measurement superintendent. Mr. Partridge, who is vice chairman of the AGA gas measurement committee, will be located temporarily in Houston and later in Salt Lake City.

R. C. KENAN has been promoted to manager, Hot Applied Coatings sales of Koppers Co. Inc., Pittsburgh. He was formerly assistant sales manager of the midwestern district of the Tar Products division.

J. T. SIMON, who has been assistant manager of the production division, has been named a new vice president of Mountain Fuel Supply Co., Salt Lake City. His duties will include general supervision of the producing and pipeline division, both of which are headquartered in Rock Springs, Wyo.

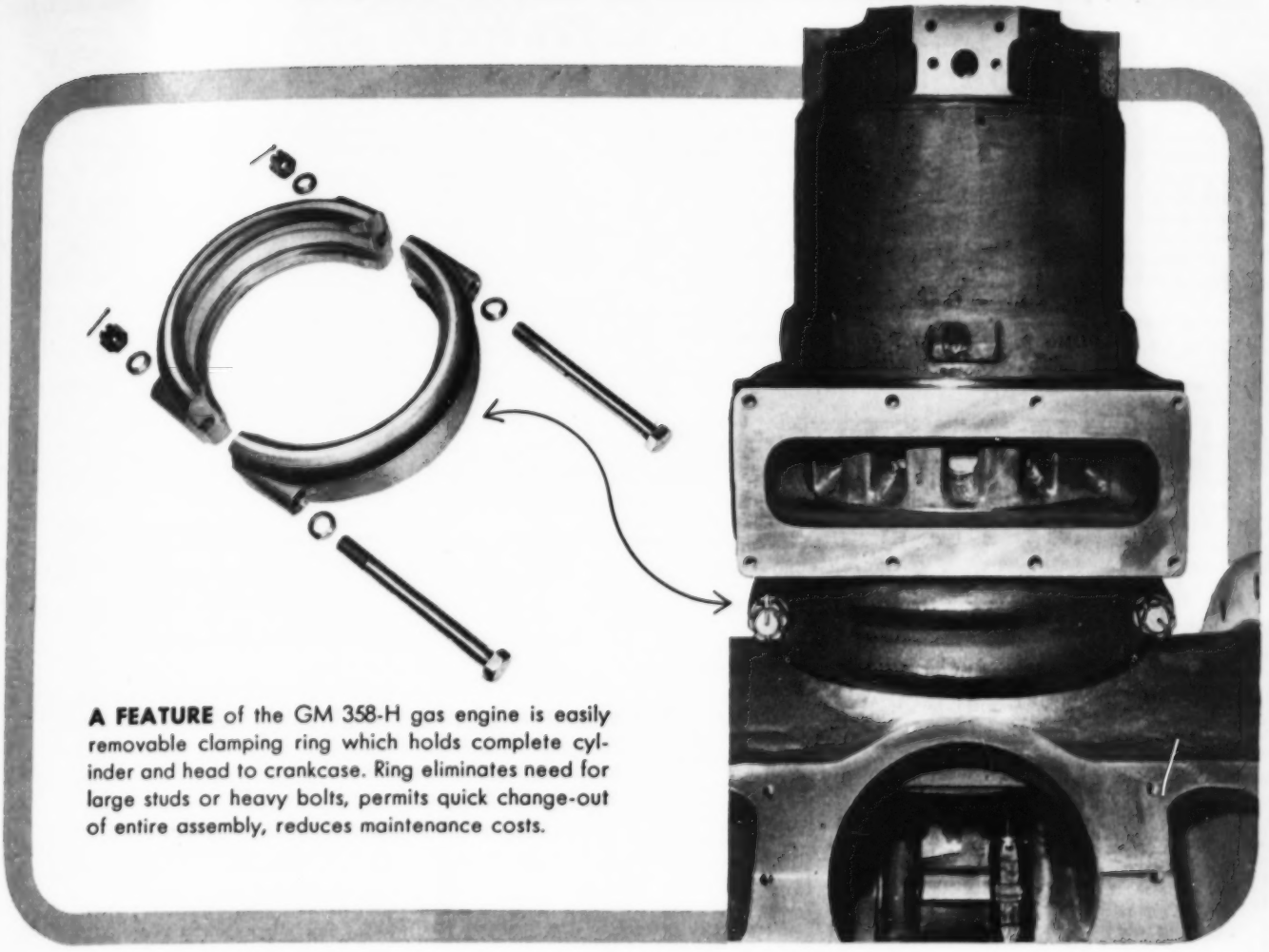
EDWARD F. HARRINGTON has joined the staff of the sales development department of Tube Turns, Louisville, Ky.

Cooper-Bessemer Corp., Mt Vernon, Ohio, has promoted DWIGHT R. CRAIG to administrative assistant, engineering department, and GEORGE W. EDICK to branch manager of compressor and stationary engine sales in New York City.

GENE MORRIS has rejoined Crutcher-Rolfs-Cummings Inc. as vice president and general manager.

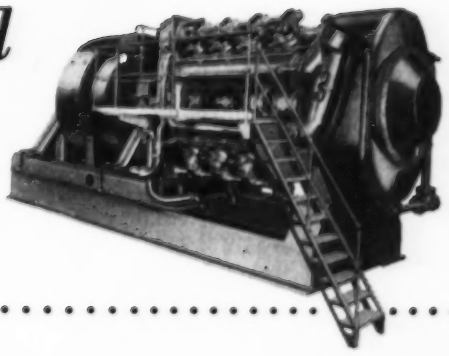
DANIEL R. FULTON will head the newly established Detroit sales office of Roots-Connersville Blower, division of Dresser Industries Inc., Connersville, Ind.

ERIC A. KERBEY, executive vice president, has been elected president of Midwest Piping Co. Inc., St. Louis. A. G. STOUGHTON, who has been president of Midwest since its formation, will continue as chairman of the board and chairman of the executive committee.



A FEATURE of the GM 358-H gas engine is easily removable clamping ring which holds complete cylinder and head to crankcase. Ring eliminates need for large studs or heavy bolts, permits quick change-out of entire assembly, reduces maintenance costs.

Lightweight, medium-speed **pipeline power**



The General Motors 3300-h.p. 358-H gas engine has features that make it your best buy for pipeline pumping power.

Light weight per horsepower, including attached accessories, reduces foundation requirements.

Freedom from vibration throughout its operating range also permits lighter foundations.

Medium-speed rating gives a lower step-up ratio speed increaser than is required by slower-speed engines.

Over-all dimensions are less than slower-speed engines in the same class. This means lower powerhouse building costs.

These are the features that will save you money in installation costs when you install a GM 3300-h.p. engine.

Full details and engineering specifications are yours promptly upon request.

General Motors 358-H **Gas Engine**

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BUILDERS OF DIESEL, DUAL-FUEL AND NATURAL-GAS-BURNING ENGINES—FROM 150 TO 3300 H.P.

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